SCIENCE.

FRIDAY, JUNE 26, 1885.

COMMENT AND CRITICISM.

THE BILL TO ESTABLISH a board of registration in medicine and surgery for Massachusetts was rejected in the house of representatives, in the latter days of the session, by a very decided majority. A brief statement of the reasons for this action is interesting, inasmuch as the same body had already created a commission for the regulation of pharmacy. The law proposed, — substantially the same as that so successfully enforced in Illinois and West Virginia, — would, with a proper machinery for its execution, have been a benefit to the community. The measure did not, however, excite a very warm interest in the medical profession as a whole, was opposed in some important details by prominent members of one of the great medical societies, and at no time attracted sufficiently the attention of the public, with the exception of that loud-mouthed portion that naturally belongs to the quack and charlatan. The men who appeared in favor of legislation were those most competent to testify to the needs of it, — the honest practitioners of medicine. The ordinary legislator, therefore, looked upon the proposed law as a privilege desired by a class; and when he found that it was advocated by that class mainly, from his limited point of view, not unreasonably perhaps, voted against the measure. With the warning furnished by this year's experience, it is safe to assume that the medical profession will insist that the public, which is alone concerned, shall hereafter take the lead in any effort to procure legislation for the regulation of the practice of medicine.

THE ESTABLISHMENT of a botanic garden in Montreal may now be considered an assured fact. The organization has been completed by the formation of a corporation, from whom there is elected a board of management of five persons, one of whom is the director of the garden, in the person of Professor Penhallow. With a grant from the provincial government for preliminary work, land from the city, and the hearty good will and co-operation of the citizens, the garden will without doubt prove successful. The site chosen for the garden is on Mount Royal, and embraces about seventy-five acres of land well adapted for the purposes of both a garden and an arboretum. A large stone building, now on the grounds, will be used as the offices, library, museum, etc., and around this the plant-houses will be built.

IN ORDER THAT composite photographs may be of use as a scientific method for revealing the traits common to some group, it seems necessary that each step of the process employed should be subjected to careful experiment. The presumption is, that any change in the order in which the negatives are used in making the composite will have no perceptible effect in altering its appearance. Yet this should be a matter of actual experiment; and, should composites so obtained not be substantially identical, the conditions for such identity must be found, before we can feel much certainty that a composite exhibits the essential features of the group in question, as distinguished from such as might be termed accidental. It might happen, for instance, that undue prominence had been given to part of a group by variation in the intensity of the illumination during the printing, or other circumstances might interfere with the accuracy of the representation.

But a more serious question respecting the truth to nature, of the average expressed by the composite, is contained in the query, whether composites of a given group made by different photographers would be recognizably the same picture, and whether they differ more widely

or less widely than single photographs do under similar conditions. The composites ought to be almost wholly independent of fortuitous circumstances such as this; and, although the separate negatives of the same individual might exhibit considerable deviations from each other for one reason or another, yet such deviations should have no cumulative effect in the composite, but be in effect obliterated. If, however, there is, as there well may be, some personal peculiarity in the adjustments of a photographer, his composite will necessarily bear the impress of this mannerism, and furnish a kind of personal error, which can perhaps be only eliminated by making a composite from a number of composites of the same group, each taken by a different person.

LETTERS TO THE EDITOR.

A modern type of plant in the cretaceous.

The genus Brasenice, or Hydropeltis, is represented in eastern North America by a single species, B. peltata, Pursh (Hydropeltis purpurea, Michaux), which, according to Gray, is also a native of Puget Sound, Japan, Australia, and India. A form so widely distributed may be expected to have been early introduced, so that we need not be surprised to find it occurring along with the earlier forms of exogenous life in the cretaceous of our north-west.

The specimens to which this note refers were obtained in the beds of the Belly-River series of the

BRASENICE ANTIQUA, UPPER CRETACEOUS, SOUTH SASKATCHEWAN RIVER. LEAF NAT. SIZE. *a*, *b*, DIAGRAMS OF VENATION, SLIGHTLY ENLARGED.

Canadian survey, near Medicine Hat. These beds are upper cretaceous, and hold fossils, some of which resemble those of the Laramie group, others those of the Pierre group. They contain workable beds of lignitic coal; and the specimens in question were found in nodular clay ironstone, associated with one of the coal-beds worked in the 'Lawson mine.'

A specimen of this interesting fossil, obtained, I believe, from Mr. Lawson, the manager of the mine, was kindly given to me last year by Mr. J. R. Byron, one of the members of the British association; and additional specimens, some of them very perfect, were afterwards collected by Mr. T. C. Weston of the geological survey. They resemble very closely the leaves of the modern species, differing only in their generally smaller size and somewhat less elliptical form, and slightly in the venation, the primary veins being more numerous, or about eighteen in number, while fourteen is a common number in the modern species. These differences may indicate merely a varietal form; but I have thought it best to designate the species or variety by the name B. antiqua. Associated with these leaves, in the same bed, are some other aquatics, notably Pistia corrugata (Lesqx.) and Lemna scutata (Dn), both species of the Laramie; and Platanus nobilis of Newberry (Aralia notata of Lesquereux), which, though apparently regarded in the United States as miocene, is certainly in Canada characteristically Laramie. There is also a new species of Populus — P. latidentata (Dn) — closely allied to the modern P. grandidentata, and an Acer (A. saskatchewense), whose leaves resemble small or immature leaves of A. dasycarpum. A species of Sequoia also occurs, probably S. Reichenbachii. Though all these plants have a very modern aspect, they are unquestionably cretaceous; and I have myself assisted at the disinterment of a dinosaur of the genus Diclonius from beds overlying those in which the leaves occur. These facts furnish another instance of that modern aspect of the upper cretaceous flora on which I have elsewhere insisted; and which has been a fertile source of error with reference to the age of beds of this formation in the west. It is interesting to note that beds of this age in western Canada contain the modern Onoclea sensibilis of America, along with Davallia tenuifolia, also modern, but now Asiatic.

J. Wm. Dawson.

Lateral movements of the earth's crust.

While observations are being made for the purpose of investigating 'variations of latitude,' is it not desirable that the U. S. coast and geodetic survey should make simultaneous observations with a view to discover, if possible, whether or not places along our coasts are suffering changes of latitude or longitude, or both, due to lateral movements of the earth's crust?

If it is true that during geological history large lateral movements of the earth's crust have taken place, and if such changes are still going on, it would seem inevitable, that, in regions where lateral displacements are taking place, landmarks should suffer a change of latitude or longitude, or of both, according to the direction of yielding to lateral pressure, and that places located upon regions suffering compression or folding should be moved, to some extent, bodily toward places in adjoining regions, toward which the movements take place, but which are not themselves undergoing displacements.

Since vertical movements of the earth's crust are taking place at measurable rates, and since, in the past, lateral movements appear to have exceeded the vertical, it might be expected that lateral movements are now taking place at measurable rates. Of course, if the superficial strata are not involved in these movements, the deeper strata only yielding, surface landmarks could not reveal the movement; but in this case, and in case folds of the superficial strata along our coasts are in process of evolution, it would seem that such changes might be discovered by sinking deep vertical shafts at intervals along lines normal to the coast. These carefully surveyed at intervals during one or two centuries, it would seem, should show a measurable warping or tilting if such movements are going on.

F. H. King.

River Falls, Wis.

Silver in mounds.

In the number of *Science* for May 22 you have an article on 'Silver from a Pennsylvania mound,' which leads me to speak of a recent find here. Within the city limits, on the west side of the river, and in the region of a group of mounds now mainly removed, there were recently found two nodules of nearly pure silver, weighing together upward of twelve pounds, together with a small piece of silver-foil. The nodules were irregular in shape, with some admixture of earthy material; but a competent chemist pronounces them essentially pure silver. With them was found a large copper axe, a large sea-shell (Pyrula?), bone spears, human bones, etc., — the usual contents of the mounds (in this region) of the so-called mound-builders. A more complete examination of these articles will be made. E. A. STRONG.

Grand Rapids, Mich., June 11.

Mound-building tribes.

'Name the mound-building tribes,' is the demand now made of those holding the Indian theory. The mound testimony so far obtained (much of it by the bureau of ethnology, and yet unpublished), taken in connection with the historical, traditional, and linguistic evidence, leads to the following conclusions: —

1. That the ancient works in eastern Arkansas, north of the Arkansas River, were chiefly built by the 'Akansea' (Quapaws or Kappas), and other allied tribes of the Dakotan stock encountered by DeSoto, and found still occupying this region when first visited by the French explorers. The evidence in support of this opinion seems to be well-nigh conclusive.

2. That some ancient works recently discovered in Pontotoc and Union counties, Miss., are probably due to the Chickasaws, who are known to have inhabited this region from the time of DeSoto's expedition until a recent date. These works have been visited and carefully explored by a bureau assistant, who discovered in one of the mounds, in addition to a number of the usual mound-builder's relics found in such works, one blade of a pair of scissors, the blade of an iron 'case-knife,' and a small silver plate stamped with the Spanish coat-of-arms. The vestiges of aboriginal art present marked differences from those found in Arkansas, western Tennessee, and the more southern portions of Mississippi. Of course the data so far obtained, relating to this locality, are too meagre to justify a decided conclusion.

3. That most of the antiquities of Alabama and Georgia are attributable to the Muskoki tribes. But the mound explorations indicate that the south-west corner of Georgia, and immediately adjoining portions of Florida, were occupied in mound-building times by a different people. It is somewhat significant that Mr. Gatschet ('Migration legend of the Creeks') locates the Uchees in precisely this area. Some specimens of pottery indicate contact with the whites, but others are more ancient. The indications are that the same people occupied this region at two different periods.

4. That the Cherokees were mound-builders, and that they were the authors of most of the works of western North Carolina and eastern Tennessee. I have given elsewhere (*Magazine of American history*, May, 1884) some reasons for this belief. Subsequent explorations have served to strengthen this opinion. A number of mounds around the site of old Fort Loudon, Monroe county, Tenn. (one of them of large size), recently opened, furnish what seem to be absolutely connecting-links between the mound-builders and Indians. From the large one, containing ninety-one skeletons, were taken dozens of polished celts; several shell masks; some engraved shells; a gallon or more of shell beads, some of them pearls; vessels of clay of ancient type; bone implements; hundreds of perforated shells; *a few pipes of a comparatively modern Cherokee type; four copper hawk-bells with shell-bead and pebble rattles;* discoidal stones, etc. No indication of intrusive burials.

But the mound testimony in regard to this tribe does not stop here. It indicates that to them we must attribute the works of Kanawha valley, near Charleston, those at Grave Creek, and the typical works of southern Ohio: in other words, it is in accord with the tradition mentioned by Haywood, and the theory which identifies them with the Talegwi. The proof is circumstantial, but the chain is unbroken: the pipes alone are sufficient to show this. We can trace them back along their line of migration to Iowa. The works of Ohio indicate several different waves of population, and occupancy for a greater or less length of time by different tribes; but the works of the Talegwi (Cherokees) are generally easily distinguished. The mound testimony absolutely forbids the idea that the Ohio mound-builders went south to the Gulf states, and merged into the Muskoki family, or were represented by the Natchez.

5. That the track of the Shawnees can be traced by their works from southern Illinois to north-eastern Georgia. They were undoubtedly the authors of the box-shaped 'stone graves,' or cysts, found south of the Ohio River, and the other works of that region directly connected with these graves. While it is probable they entered it from the west, possibly along the line of the lower Missouri River, the works at the eastern end of the elongate area bear the marks of greatest age, unless we attribute to them the Cahokia pyramid and its companions. The region of the Cumberland valley and middle Tennessee was evidently their chief and most permanent seat of power. The later occupancy by them and by the Delawares, of various points in Ohio, is generally indicated by their stone coffins and mode of burial.

6. That a large portion of the works of Kentucky differ from all others east of the Mississippi, north-eastern Missouri alone presenting any thing similar. The only probable solution of the puzzle is, that a tribe which once inhabited this section has become extinct, or fled west, and was absorbed in some other tribe, or became nomadic. And, last, that Morgan's theory that the mound-builders were from the pueblo Indians is without foundation.

The evidence on which these conclusions are based cannot be presented here, but will be given in the report on the mound explorations of the bureau of ethnology for the years 1882–85, now being prepared for publication. CYRUS THOMAS.

Abert's squirrel.

That the credit of first publishing a drawing of Abert's squirrel may be given to the proper person, I beg, through you, to call Dr. Shufeldt's attention to the illustration of it that is contained in Senate ex-doc. No. 59, 32d congress, 2d session, 1853: "Report on the natural history of the country passed over by the exploring expedition under the command of Brevet Capt. L. Sitgreaves, U. S. topographical engineers, during the year 1851, by S. W. Woodhouse, M.D., surgeon and naturalist to the expedition."

Plate 6 is a full-length view of the animal, and on pp. 53, 54, is a description in detail of this Sciurus.

New York, June 15. L. S. FOSTER.

A complete fibula in an adult living carinate-bird.

In reference to the important anatomical point contained in the letter of Dr. G. Baur to *Science* (No. 118) in regard to the fibula of Pandion, I would like to invite your correspondent's attention to the condition of the fibula in the adult Colymbus septentrionalis. I have in my temporary possession a complete skeleton of an adult individual of this diver, kindly lent me by the Smithsonian institution (spec. 13,646) for another purpose. In it the fibula is found, as I have drawn the specimen in the accompanying cut, for the right limb, though it is seen equally well in both. The fibula has been drawn in black for its entire length, so that its exact form and relation to the tibio-tarsus may be properly appreciated. From the point *a* to *b* it anchyloses with the shaft of the other leg-bone, though it stands out quite prominently from it, leaving no doubt as to its identity. Knowing as we do that the part indicated in the cut by *c* represents one of the tarsal elements, it is no more than we should expect to have a complete fibula terminate, as it does in this bird, at *b*; and this part, in common with Pandion, is found upon the antero-lateral aspect rather than in front of the tibio-tarsus, as in the Jurassic Archaeopteryx.

BONES OF RIGHT THIGH AND LEG OF ADULT COLYMBUS SEPTENTRIONALIS. REDUCED ONE-HALF.

F, femur; *P*, patella; *Fb*, fibula (in black); *T*, tibio-tarsus; *a*, point where anchylosis commences; *b*, distal extremity of fibula; *c*, the united tarsal element; *d*, a fibrous loop for tendon; *e*, the large oblique fibrous loop for extensor tendons; *f* indicates the position of the bony bridge that confines the deep extensors.

Dr. R. W. Shufeldt.

Fort Wingate, N. Mex., June 8.

The classification and paleontology of the U.S. tertiary deposits.

Under this head a note was published in the number of June 12 of this journal, on the first part of my article, 'The genealogy and the age of the species in the southern old tertiary,' in the *American journal of science* for June. I refer those readers of *Science* who are interested in this matter to the second part of this article, which will appear in the July number of the same journal. Dr. Otto Meyer.

New Haven, Conn., June 15.

HOW TO REACH THE GRAND CAÑON.

Although the Grand Cañon of the Colorado was a good while ago made famous as to its lower part by Ives and Newberry, and the upper by Powell, and although most interesting parts of it are nearly approached by one of the great transcontinental railways, yet very few people seem to know how easy it is to visit it, — easy, that is, to one who is crossing the continent by the Atlantic and Pacific railroad. It was almost by accident that we came to know of this accessibility, and to take advantage of it.

We know not what facilities there may be for reaching the lower end of the cañon from 'The Needles,' where the road crosses the Rio Colorado; but the Peach-Spring station, where this road approaches within twenty-three miles of the river, at its strong southern bend, is about six hours east of 'The Needles,' and on the plateau about five thousand feet higher. From this point a rapid and easily traversed descent leads down to the river, and into as majestic and peculiar cañon scenery as is anywhere to be seen. Unfortunately the trains, both from the east and the west, at present arrive at this little watering-station between two and three o'clock in the morning; and intending visitors will find it well, if not exactly necessary, to notify the station-master or the 'stage proprietor' in advance, so as to secure lodgings for the remainder of the night. Mr. Farlee, the stage proprietor, into whose hands they will fall, provides three or four comfortable beds; the restaurant of the station, which supplies the employees of the railroad, will furnish a tolerable breakfast; and a three-seated wagon, upon the buckboard principle, drawn by four experienced horses, makes a really comfortable conveyance. All that the traveller needs to provide is a sun-umbrella, — an article which will probably be needed at any season. A quick descent of four thousand feet into a narrow ravine is sure to be attended by a corresponding rise in temperature; and shade during the journey is not abundant.

Dr. Newberry and his exploring party were the first white people to make this trip, in April, 1858; and his account of it in Ives's report upon the Colorado River of the west, along with the woodcut on p. 99 and the annexed plate vi., and plate i. of the geological part, opposite p. 54, will give a fair idea of what is to be seen. Nothing is changed, except that the Indian trail, over which his pack-mules made their way with much difficulty, is now replaced with a passable wagon-road of Mr. Farlee's making. Very enterprising and hurried people make the trip in a single day, especially in the long days of spring, and so resume the railroad by the next (daily) train, the journey back and forth being made in the early morning and in the evening hours. But, indeed, two days should be given to it, even by the transient sight-seer, lodging in the

'hotel' in the bottom of the cañon. This is a board shanty of a single room below, with a kitchen attached, and two bedrooms under the roof above. Primitive as the accommodations are, and although, when there is no press of company expected, the functions of stage proprietor, road-owner, driver, guide, landlord, and cook are all merged in one person, we found that person adequate to all those duties; and even the lady of our party was comfortably cared for, both as to bed and board. When this extraordinary place comes to be better known and more largely visited, ampler accommodations will doubtless be provided, both in the cañon and at the railway-station. The 'hotel' stands at the junction of the Peach-Spring Cañon and that of the Diamond River, close to the refreshing stream of pure water. The Diamond-River Cañon, of which Dr. Newberry gives two good illustrations, was explored upward for two or three miles on the afternoon of the first day. The following morning suffices for the junction of this cañon with the Colorado, which is near by, and for the views up and down the river, which are to be had for less than an hour of climbing. Altogether, there is nothing like this cañon. The far-famed Yosemite is more beautiful and more varied, but not more magnificent, nor half so strange and weird.

I may be allowed to add the remark that the botany of these lateral cañons is very interesting, and inviting to a longer stay. It had been so well explored by Mr. and Mrs. Lemmon a year before, that we could not expect our hurried visit to be rewarded with any thing absolutely new. But here we saw an abundance of the singular and striking Fouquieria in flower, and that alone well repaid the toils of the excursion.

This is the only accessible point at which a descent can be made into the bed of the Grand Cañon. But from Flagstaff — a station about nine hours farther east, and at considerably greater elevation, in a district of pine-forests, and close to the beautiful and snow-clad San Francisco mountains — a wagon-journey of two days over the mesa will take a party to the Marble Cañon, described and illustrated by Powell, where the Colorado flows twenty-five hundred feet below, between unbroken vertical walls of many-colored marbles. Moreover, the neighborhood of Flagstaff abounds in cliff-dwellings and cave-dwellings, the latter comparatively little known; and altogether this seems to us a most inviting place of summer resort.

Journeying eastward, the traveller passes one of the most interesting of the Indian pueblos, that of Laguna; and that of Zuñi is well within reach from Fort Wingate.

A. G.

THE WASHINGTON MONUMENT, AND THE LIGHTNING STROKE OF JUNE 5.

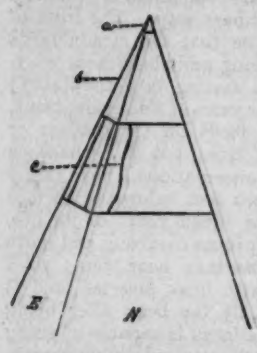
THE recent injury to the Washington monument by lightning has attracted attention throughout the country to such a degree that a short statement of the facts in the case will doubtless be of interest to the readers of *Science*. On the afternoon of June 5 a thunder-storm of no unusual character passed over Washington. At about fifteen minutes past three there was a single burst of thunder of some violence, which was about the only notable electrical disturbance of the afternoon. Although it had successfully passed through disturbances apparently much more violent on one or two previous occasions, this time the monument was 'struck,' and some damage done to one of the stones near the apex. Two men who were inside of the structure, at the base, describe the sound produced as resembling the simultaneous discharge of a great number of cannon, and declare that the 'whole monument trembled.' Two others were in a small wooden building, used as an office, near by. One of them was looking out of the window, away from the monument, toward the north. He affirms, in the most positive manner, that he saw a ball of fire, which he says was as large as his fist, coming directly towards the window out of which he was looking. Both he and his companion (who was not looking out of the window, and who did not see the ball of fire) seem to have felt something of the usual effect of a shock. Those who were within the monument say they felt no unusual sensations except those produced by the noise.

When the monument was examined from the ground with the unaided eye, no injury could be detected. On applying a good telescope, however, it was seen that one of the stones just below the capstone was split from top to bottom, the crack produced being about four feet long, and it was open to the extent of about two inches. A small corner of the lower corresponding angle of the capstone had also been carried away, this doubtless resulting from the opening of the crack in the stone upon which it rested.

The appearance of the apex is fairly represented in the sketch, in which (*a*) represents the aluminum tip, (*b*) the capstone, and (*c*)

shows the crack in the stone in the next lower course.

Col. T. L. Casey, U.S.A., the engineer in charge of the construction of the monument, requested Professors Rowland of Baltimore, Newcomb of the U. S. navy, and Mendenhall of the signal-service, to examine the monument, and recommend such additions to the present arrangements for protection from lightning as would seem to them necessary and sufficient. It was ascertained on examination, that, with the exception of that shown in the sketch, the monument showed no evidence whatever of having received the stroke. A careful examination of the tip of the aluminum apex has not yet been made; but it seems likely that it will be found to be somewhat blunted by fusion, as is so often the case even where no other effect of the stroke is to be seen.



This aluminum pyramid is secured to the capstone by a heavy copper bolt one and a half inches in diameter. From the end of this, four copper rods, each three-quarters of an inch in diameter, are carried to the extremities of four heavy iron columns extending to the base of the monument, inside of which the elevator runs. As originally put in, these rods are bent out towards the four corners of the pyramid near which they run on their way to these iron columns. Just where one of these is nearest to the angle of the pyramid, and hence nearest to the outside of the structure, the rupture occurred; and to this must doubtless be attributed the localization of the stroke.

The damage done to the monument is in reality very small, and can easily be repaired; but the accident is exceedingly instructive to those interested in lightning protection. The conducting power of the interior seems to be ample for any discharge which could possibly occur, and no evidence appears of any weakness in this respect; but it is evident that the aluminum apex alone does not possess sufficient collective or distributing power, and the improvements suggested by the committee will doubtless be in the direction of increasing that power by the addition of more metal.

M.

Washington, D.C., June 15.

THE PERIODICAL CICADA.[1]

Just at this time considerable interest is manifested in this curious insect, because of the concurrence of two extensive broods, the one belonging to the typical septendecim form, the other to the tredecim race. These two broods appeared simultaneously in 1664, and will not concur again till the year 2106. The following are the localities in which these two broods will respectively occur: —

Tredecim (1872, 1885).

Illinois. — Jackson, Union, Macoupin counties.

Missouri. — St. Louis, Boone counties.

Georgia. — DeKalb, Gwinnett, Newton counties.

Tennessee. — Madison county, and northern portion of the state.

Mississippi. — Copiah county, Oxford, and eastern portion of the state.

Louisiana. — Carroll Parish.

Kansas. — Phillips county.

Arkansas. — Flat Bayou.

The existence of this brood has been verified in past years in the parts of Illinois, Missouri, Tennessee, Mississippi, and Arkansas, indicated; but the localities in Kansas, Georgia, and perhaps Louisiana, require further confirmation this year.

Septendecim (1868, 1885).

New York. — Kings, Monroe counties.

Massachusetts. — Fall River, south-east portion of the state.

Vermont. — Rutland.

Pennsylvania. — Lancaster.

Ohio. — Green, Franklin, Columbiana, Pike, Miami counties, and vicinity of Toledo.

Indiana. — Tippecanoe, Delaware, Vigo, Switzerland, Hendrick, Marion, Dearborn, Wayne, Floyd, Jefferson counties.

Michigan. — South-eastern portion.

Delaware. — Very generally.

Maryland. — Very generally.

District of Columbia. — Very generally.

Virginia. — Very generally.

Kentucky. — Around Louisville.

Georgia. — Habersham county.

From chronological data, the fact that seventeen years or thirteen years are respectively required for the underground development of this insect, according to the race, is fully established, one of the first recorded septendecim broods having been observed every seventeen years since 1715. Such anomalous and excep-

[1] Extracts from a paper read to the Biological society of Washington, May 30.

tional facts in natural history always provoke scepticism, and the facts recorded regarding our cicada's hypogean life have shared in this tendency. Hence a few facts, especially such as bear on the development of the larva, will not prove uninteresting.

Of the tredecim brood which appeared in 1868, I have taken pains to follow the larval development as far as possible from year to year, my observations having been made in St. Louis county, Mo. Repeated efforts to rear the young larvae in confinement proved unsuccessful; and it was necessary to resort to careful and repeated digging out-doors in order to watch the growth from year to year. One of my employees at Cadet, Mo., has also been instructed to carefully pursue the same subject, and I have repeated the digging since residing in Washington. These observations have in all cases been made in special localities where the date of entering the ground was well known and observed. I have thus been able to follow the larvae for the first six years with great care, and for subsequent years with less care and continuity. As we might expect from the chronological history of the species, the development of the larva is extremely slow; and at six years old it has hardly attained one-fourth of its full size. Notwithstanding this slow development, moulting takes place frequently; i.e., the number of larval stages is more than one per annum, and probably twenty-five or thirty in all, whereas in the Homoptera generally — the suborder to which Cicada belongs — it ranges from two to four. In any hypogean insect which continually uses its claws in burrowing, the need of shedding and renewal of those organs is apparent, and may afford the chief explanation of this repeated exuviation, though the slow development is a factor; since my own experience has shown, in the larvae of other orders, that, in proportion as development is slow, exuviation is frequent. As the claws of the front tibiae are the chief instruments used in burrowing, the tarsi become useless or obstructive, and are gradually reduced, and finally lost. They are then regained suddenly during one of the later moults, but so articulated that they are thrown back on the inside of the tibiae, and form a good brace for strengthening these. They are thus out of the way for underground work, and come into use, with their well-preserved claws, only when the pupa issues from the ground, and ascends for the final change.

Much difference of opinion has been expressed by different writers as to the food of the larva; and this is not to be wondered at, from the fact that there is great difficulty in observing it feed. Dr. G. B. Smith insisted that it obtained its nourishment from the moisture of the earth, through capillary hairs at the tip of the proboscis; while many others have seen it with its beak inserted in the roots of trees, and pumping the sap therefrom. The former method is insisted on by Dr. Smith from his own observations; but while I think it not improbable, especially during its earlier larval life, that the cicada may feed on earth-exudation, — a belief which receives support from the well-known fact that this cicada will issue from ground that has been cleared of timber and cultivated for nearly seventeen years, and that other species are known to issue from the prairies, — the liquid is evidently pumped up in the ordinary way. The truth of the matter seems to be that the cicada larva can and does go for long periods without nourishment, where such fasting is necessitated; and that in the earlier years of its development, more particularly, it feeds on the rootlets or radicles, not only of trees, but of herbaceous plants. In my own observations I have rarely found it more than two feet below the surface during the first six or seven years of its life, and almost invariably in an oval cell, and more often away from roots than near them; yet I have also found it with beak inserted, and it will often hang fast by the beak after being unearthed. That the larva is capable of going to great depths is well attested by observers. Many of such reports may be based on the unobserved tumbling of the larva from higher levels; but, where the insect has been observed to issue from the bottoms of cellars ten feet deep, the information would certainly seem to be reliable.

The method of burrowing and making its cells is quite interesting. With the strong front tibial claws it scratches away the walls of its cell just as one would do with a pick; and if it is rising, so that the earth removed naturally falls to the posterior end of the burrow, it simply presses the detached portions on all sides, and especially on the end of the cavity, by means of its abdomen and middle and hind legs. If, however, it is burrowing downward, and the loose soil has to be pressed against the top of the cavity, it uses its broad front femora very dexterously in making a little pellet of the soil, and in placing it on the clypeal or front part of the head, when the load is carried up, and pressed against the top of the cavity. The motions made in cleaning its fore-arms remind one very forcibly of those made by a cat in cleaning its face. The femora

and bent tibiae are rubbed over the clypeus, the numerous stiff hairs on which act like a comb or a brush in freeing the spine of dirt.

As the time approaches for the issuing of the pupa, it gradually rises nearer and nearer to the surface; and, for a year or two before the appearance of any given brood, the pupa may be dug up within one or two feet of the surface.

In the year of their ascent, from the time the frost leaves the ground, they are found close to the surface, and also under logs and stones, seeming to await the opportune moment, and apparently without feeding. They begin to rise from about the 20th of May in more southern localities, and but little later farther north. In Washington, the present year, they began to rise in scanty numbers about the 23d, and were perhaps most numerously rising on the night of the 27th. Those in the city were somewhat earlier than those in the woods just over on the Virginia side. The unanimity with which all those which rise within a certain radius of a given tree crawl in a bee-line to the trunk of that tree, is most interesting. To witness these pupae in such vast numbers that one cannot step on the ground without crushing several, swarming out of their subterranean holes and scrambling over the ground, all converging to the one central point, and then in a steady stream clambering up the trunk, and diverging again on the branches, is an experience not readily forgotten, and affording good food for speculation on the nature of instinct. The phenomenon is most satisfactorily witnessed where there is a solitary or isolated tree.

The pupae begin to rise as soon as the sun is hidden behind the horizon, and they continue, until, by nine o'clock, the bulk of them have risen. A few stragglers continue until midnight. They instinctively crawl along the horizontal branches after they have ascended the trunk, and fasten themselves in any position, but preferably in a horizontal position on the leaves and twigs. In about an hour after rising and settling, the skin splits down the middle of the thorax from the base of the clypeus to the base of the metanotum, and the forming cicada issues. Ecdysis is always an interesting phenomenon, and, when closely watched in our cicada, cannot fail to entertain.

There are five marked positions or phases in this act of evolving from the pupa-shell; viz., the straight or extended, the hanging head downward, the clinging head upward, the flat-winged, and, finally, the roof-winged. In about three minutes after the shell splits, the forming imago extends from the rent, almost on the same plane with the pupa, with all its members straight, and still held by their tips within the exuvium. The imago then gradually bends backwards, and the members are all loosened and separated. With the tip of the abdomen held within the exuvium, the rest of the body hangs extended at right angles from it, and remains in this position from ten to thirty minutes or more, the wing-pads separating, and the front pair stretching at right angles from the body, and obliquely crossing the hind pair. They then gradually swell, crimp, and curl, until they form a more or less perfect loop; and during all this time the legs are becoming firmer, and assuming the natural positions. Suddenly the imago bends upward with a great deal of effort, and, clinging with its legs to the first object reached, — whether leaf, twig, or its own shell, — withdraws entirely from the exuvium, and hangs for the first time with its head up. Now the wings perceptibly swell and expand, until they are fully stretched, and hang flatly over the back, perfectly transparent with beautiful white veining. As they dry, they assume the roofed position, and during the night the natural colors of the species are gradually assumed.

The time required in the transformation varies; and though from the splitting of the skin, and the full stretching of the wings in the flat position, the time is usually about twenty minutes, it may be, under precisely similar conditions, five or six times as long. But there are few more beautiful sights than to see this fresh-forming cicada in all the different positions, clinging and clustering in great numbers to the outside lower leaves and branches of a large tree. In the moonlight, such a tree looks for all the world as though it were full of beautiful white blossoms in various stages of expansion.

That this insect, in its distribution and in its numbers, has been and is being seriously affected by our civilization, must be apparent to every observer. The records show that the numbers have decreased in the successive appearances of certain broods, owing largely to the presence of our domestic animals in the woods. Then, again, the clearing of land and the building of towns and cities have all had their effect upon the decrease of this cicada. There are doubtless many places in Brooklyn, N.Y., where the insect appeared seventeen years ago, in which there will be none the present year. And similarly, I believe that whereas around every tree that has been planted more than seventeen years, or upon land that grew trees seventeen years ago, the

insect is now abundant in Washington, it will scarcely be noticed in any part of the District seventeen years hence. I base this opinion upon a new phase in the cicada history; viz., the presence of the English sparrow. It is the first time, perhaps, in the history of the world, that Passer domesticus has had an opportunity of feeding upon this particular brood of Cicada septendecim: and so ravenously and persistently does this bird pursue its food, that the ground is strewn with the wings of the unfortunate cicada wherever these have been at all numerous; so that, considering the numbers of the sparrow and their voracity, very few of the cicada will be left long enough to procreate and perpetuate the species in this District.

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THE GEOLOGY OF NATURAL GAS.

THE recent introduction of natural gas into general use as a source of heat for industrial and domestic purposes has raised it from the rank of a mere curiosity to one of the earth's most valuable treasures.

To the reader unacquainted with the great change natural gas has effected in all industries where it can be obtained, the following quotation from an article in *Macmillan's magazine* for January, written by Mr. Andrew Carnegie, the chief iron master of Pittsburgh, will be a revelation: "In the manufacture of glass, of which there is an immense quantity made in Pittsburgh, I am informed that gas is worth much more than the cost of coal and its handling, because it improves the quality of the product. One firm in Pittsburgh is already making plate glass of the largest sizes, equal to the best imported French glass, and is enabled to do so by this fuel. In the manufacture of iron, and especially in that of steel, the quality is also improved by the pure new fuel. In our steel-rail mills we have not used a pound of coal for more than a year, nor in our iron mills for nearly the same period. The change is a startling one. Where we formerly had ninety firemen at work in one boiler-house, and were using four hundred tons of coal per day, a visitor now walks along the long row of boilers, and sees but one man in attendance. The house being whitewashed, not a sign of the dirty fuel of former days is to be seen; nor do the stacks emit smoke. In the Union iron-mills our puddlers have whitewashed the coal-bunkers belonging to their furnaces. Most of the principal iron and glass establishments in the city are to-day either using this gas as fuel, or making preparations to do so. The cost of coal is not only saved, but the great cost of firing and handling it; while the repairs to boilers and grate-bars are much less."

This new fuel, which bids fair to replace coal almost entirely in many of our chief industrial centres, has not received that attention from the geologist which its importance demands. So far as the writer is aware, nothing has been published on the subject which would prove of any value to those engaged in prospecting for natural gas, and it is the existence of this blank in geological literature that has suggested the present article.

Practically all the large gas-wells struck before 1882 were accidentally discovered in boring for oil; but, when the great value of natural gas as fuel became generally recognized, an eager search began for it at Pittsburgh, Wheeling, and many other manufacturing centres.

The first explorers assumed that gas could be obtained at one point as well as another, provided the earth be penetrated to a depth sufficiently great; and it has required the expenditure of several hundred thousand dollars in useless drilling to convince capitalists of this fallacy which even yet obtains general credence among those not interested in successful gas companies.

The writer's study of this subject began in June, 1883, when he was employed by Pittsburgh parties to make a general investigation of the natural-gas question, with the special object of determining whether or not it was possible to predict the presence or absence of gas from geological structure. In the prosecution of this work, I was aided by a suggestion from Mr. William A. Earsenian of Allegheny, Penn., an oil-operator of many years' experience, who had noticed that the principal gas-wells then known in western Pennsylvania were situated close to where anticlinal axes were drawn on the geological maps. From this he inferred there must be some connection between the gas-wells and the anticlines. After visiting all the great gas-wells that had been struck in western Pennsylvania and West Virginia, and carefully examining the geological surroundings of each, I found that every one of them was situated either directly on, or near, the crown of an anticlinal axis, while wells that had been bored in the synclines on either side furnished little or no gas, but in many cases large quantities of salt water. Further observation showed that the gas-wells were confined to a narrow belt, only one-fourth to one mile wide, along the crests of the anticlinal folds. These facts seemed to connect gas territory

unmistakably with the disturbance in the rocks caused by their upheaval into arches, but the crucial test was yet to be made in the actual location of good gas territory on this theory. During the last two years, I have submitted it to all manner of tests, both in locating and condemning gas territory, and the general result has been to confirm the anticlinal theory beyond a reasonable doubt.

But while we can state with confidence that all great gas-wells are found on the anticlinal axes, the converse of this is not true; viz., that great gas-wells may be found on all anticlinals. In a theory of this kind the limitations become quite as important as, or even more so than, the theory itself; and hence I have given considerable thought to this side of the question, having formulated them into three or four general rules (which include practically all the limitations known to me, up to the present time, that should be placed on the statement that large gas-wells may be obtained on anticlinal folds), as follows:—

(*a*) The arch in the rocks must be one of considerable magnitude; (*b*) A coarse or porous sandstone of considerable thickness, or, if a fine-grained rock, one that would have extensive fissures, and thus in either case rendered capable of acting as a reservoir for the gas, must underlie the surface at a depth of several hundred feet (five hundred to twenty-five hundred feet); (*c*) Probably very few or none of the grand arches along mountain ranges will be found holding gas in large quantity, since in such cases the disturbance of the stratification has been so profound that all the natural gas generated in the past would long ago have escaped into the air through fissures that traverse all the beds. Another limitation might possibly be added, which would confine the area where great gas-flows may be obtained to those underlaid by a considerable thickness of bituminous shale.

Very fair gas-wells may also be obtained for a considerable distance down the slope from the crest of the anticlinals, provided the dip be sufficiently rapid, and especially if it be irregular, or interrupted with slight crumples. And even in regions where there are no well-marked anticlinals, if the dip be somewhat rapid and irregular, rather large gas-wells may occasionally be found, if all other conditions are favorable.

The reason why natural gas should collect under the arches of the rocks is sufficiently plain, from a consideration of its volatile nature. Then, too, the extensive fissuring of the rock, which appears necessary to form a capacious reservoir for a large gas-well, would take place most readily along the anticlinals where the tension in bending would be greatest.

The geological horizon that furnishes the best gas-reservoir in western Pennsylvania seems to be identical with the first Venango oil-sand, and hence is one of the Catskill conglomerates. This is the gas-rock at Murraysville, Tarentum, Washington, Wellsburg, and many other points. Some large gas-wells have been obtained in the subcarboniferous sandstone (Pocono), however, and others down in the third Venango oil-sand (Chemung).

In Ohio, gas-flows of considerable size have been obtained deep down in the Cincinnati limestone, while in West Virginia they have been found in the Pottsville conglomerate: hence natural gas, like oil, has a wide range through the geological column, though it is a significant fact that it is most abundant above the black slates of the Devonian.

Of the composition, probable origin, extent of gas territory in the country, and many other interesting points connected with natural gas, the necessary brevity of this article forbids any mention; but the writer has in preparation a more general paper on the subject, in which these and kindred questions will be discussed with more detail. I. C. White.

THE EFFECTS OF COLD ON LIVING ORGANISMS.

Mr. Coleman and Professor McKendrick have made some remarkable experiments[1] on the effect of low temperatures on living organisms, particularly microbes, using for this purpose the cold-air machinery invented by Mr. Coleman, which, in its ordinary working, delivers streams of air cooled to about 80° below zero (−63° C.), but by certain modifications as low temperatures can be secured as have yet been produced in physical researches. The actual temperatures in these experiments were taken by an absolute alcohol thermometer, made by Negretti and Zambra, and checked by a special air thermometer devised by Mr. Coleman.

The experiments consisted in exposing for hours to low temperatures putrescible substances in hermetically sealed tins or bottles, or in flasks plugged with cotton wool. The tins or flasks were then allowed to thaw, and were kept in a warm room, the mean temperature of which was about 80° F. They were then opened, and the contents submitted to microscopical examination. The general result may be stated thus: The vitality of micro-organisms cannot be destroyed by prolonged exposure to extreme cold. It is clear, therefore, that any hope of preserving meat by permanently sterilizing it by cold must be

[1] Proc. Philos. soc. Glasgow, March 4, 1885.

abandoned; for the microbes, which are the agents of putrefaction, survive the exposure.

Some of the experiments on which this conclusion rests are briefly described. Meat in tins, exposed to — 63° C. for six hours, underwent (after thawing) putrefaction with generation of gases. Trials with fresh urine showed that freezing at very low temperatures delayed the appearance of the alkaline fermentation, but a temperature of — 63° C. for eight hours did not sterilize the urine. Samples of fresh milk exposed to temperatures of from zero to — 80° F. for eight hours, curdled, and showed the well-known Bacterium lactis; and, so far as could be observed, freezing did not delay the process after the flasks were kept at a temperature of about 50° F. Similar results were obtained with ale, meat-juice, vegetable infusions, etc.

It is probable that the micro-organisms were frozen solid. One cannot suppose that in these circumstances any of the phenomena of life take place: the mechanism is simply arrested, and vital changes resume their course, when the condition of a suitable temperature is restored. These considerations led the authors to examine whether any of the vital phenomena of higher animals might be retained at such low temperatures. They ascertained that a live frog may be frozen through quite solid in about half an hour at a temperature of — 20° F. to — 30°. On thawing slowly, in two instances the animal completely recovered. After longer exposure the animals did not recover. In two cases frogs were kept in an atmosphere of — 100° F. for twenty minutes, and although they did not revive, yet, after thawing out, their muscles still responded feebly to electrical stimulation. One experiment was performed on a warm-blooded animal, — a rabbit. The cold-blooded frog became as hard as a stone in from ten to twenty minutes, but the rabbit produced in itself so much heat as enabled it to remain soft and comparatively warm during an hour's exposure to — 100° F. Still its production of heat was unequal to make good the loss; and every instant it was losing ground, until, at the end of the hour, its bodily temperature had fallen about 56° F. below the normal, but was still 143° F. above the surrounding temperature. When taken out, the animal was comatose, and reflex action was abolished. Placed in a warm room, its temperature rose rapidly, and the rabbit completely recovered.

The observations are of great value, and highly suggestive. Those upon the rabbit indicate that death from cold is preceded by loss of consciousness, owing to the early suppression of the activity of the gray matter of the encephalon. This confirms the belief that death by freezing is comparatively painless. The viability of microbes at low temperatures has also been demonstrated by Pictet and Yung,[1] who found that various bacilli can survive — 70° C. for a hundred and nine hours. After such exposure, Bacillus anthracis retained its virulence when injected into a living animal.

We cannot refrain from asking, Are not frozen micro-organisms the means of disseminating life through the universe? An affirmative answer is at least a better hypothesis than the assumption of spontaneous generation to account for the origin of life on the earth. May not life be coeval with energy? May it not have always existed?

CHARLES S. MINOT.

[1] *Comptes rendus*, Paris, xcviii. 747.

PREHISTORIC AMERICAN SCULPTURES.

AMONG the many interesting sculptures in stone of the prehistoric Americans are those found in

HUMAN SACRIFICE. BAS-RELIEF AT SANTA LUCIA COSUMALHUPA. (*La Nature.*)

Guatemala, which were first described by Dr. Habel in No. 209 of Smithsonian contributions to knowledge, 1879. These were principally fallen monoliths which were discovered in 1862, near the village of Santa Lucia Cosumalhupa, near the base of the Volcano del Fuego. Several of these carvings were afterwards secured by Dr. Bastian for the Berlin museum. The majority of those figured by Dr. Ha-

bel are in cavo-relievo, similar to many of the Assyrian sculptures. Most of these carvings represent sacrifice and adoration. Dr. Habel considers that they represent a period of culture when the people were passing from the worship of the sun and other heavenly bodies to that of man, or the beginning of anthropomorphism. One of these monoliths, which is a stone twelve feet high, three feet wide, and two feet thick, is reproduced in the accompanying figure. It is supposed to represent a priest offering the sacrifice of a human being. He holds the head in his left hand, and in his right is the knife with which he has severed the head from the body upon which he stands. At the lower part of the stone two attendant figures are represented, each carrying a human head. One of these smaller figures has a skull for a head, and is supposed to symbolize death. This figure also occurs on other of these carved stones. The elaborate ornamentation of the naked body of the priest is characteristic of all the figures given by Habel. In this instance the headdress is in the form of a crab, and the hair is arranged in a sort of queue, with many decorations appended. The ear has a small ring in the lobe, from which hangs a larger ring. Around the neck is a cord and tassel, and about the waist is an elaborate girdle having at the back the head of an animal. Just below the right knee there is a garter. This occurs on all similar figures. The left foot is protected by a sandal. In some of the other figures both feet have sandals, and in one both are naked. The curved figures above the right hand of the priest, and below the body of the victim, are supposed to represent speech, as they occur with various modifications in several other carvings. In connection with these singular Central-American works of art, it is of interest to recall the carved shells found in mounds in the United States, and recently figured by Mr. Holmes in the report of the Bureau of ethnology, as the expression of ideas in a similar manner suggests a common origin.

THE PROPOSED CHANGE IN THE ASTRONOMICAL DAY.

Two eminent astronomers have recently given their views on the proposed change of the astronomical day, and both are inclined to favor the change. This discussion, which is of particular interest to astronomers, is on the sixth resolution of the Prime-meridian conference of Washington, — "that the conference expresses the hope, that, as soon as may be practicable, the astronomical and nautical days will be arranged everywhere to begin at mean midnight." The present custom, as we know, is for the astronomer to begin his day at noon of the civil day; and we are glad to find given at some length the opinions of such authorities as Struve and Oppolzer.

Professor Struve, director of the Pulkowa observatory, in a pamphlet[1] of twenty-seven pages, gives a very interesting account of the causes which led to the international conference, and the results which it reached. In regard to the change in the beginning of the astronomical day, he thinks that the question before astronomers is not only of giving up a long-established custom, with consequent changes of rules of many years' standing, but it also involves a serious interruption of astronomical chronology. Without a doubt, the astronomer would have to make a decided sacrifice in conforming to the wish of the conference; but, after all, this sacrifice is no greater than our forefathers made when they changed from the Julian to the Gregorian calendar, — a sacrifice to convenience of which we are still made sensible whenever we have occasion to go back to early observations.

We need have little hesitation in making a similar sacrifice, if it will prevent discordance between the civil and scientific custom of reckoning time, particularly troublesome where astronomical establishments come in contact with the outer world.

Professor Struve states that the Pulkowa observatory is prepared to adopt the new time, the only question being as to the epoch when the change should be introduced in the publications of the observatory. He is inclined to recommend that this should be deferred until some agreement can be reached by astronomers, and until the new time is adopted in the Ephemerides. This might be for the year 1890, or perhaps, better still, at the beginning of the next century.

Professor Oppolzer has contributed a paper on the proposed change of the astronomical day to the March number of the *Monthly notices of the Royal astronomical society* (vol. xlv. pp. 296–298). He says, "When once such a universal time is introduced for all purposes, it is quite natural that the question must arise, if there is indeed so great a necessity to retain in astronomy, and only in astronomy, a different reckoning of time. I fail to see this necessity, and I do not think that it would cause any serious trouble or confusion if a change were to be made in our astronomical reckoning; whilst a special mode of reckoning time in one science only, when all others use the generally adopted standard, will, without doubt, be a source of error and confusion." He then takes up in some detail the objections urged against the proposed change by Professor Newcomb in a previous communication to the same publication (vol. xlv. pp. 122, 123), and he discusses the changes which would be necessary in the Ephemerides. Professor Oppolzer proposes to give practical effect to his views by adopting the new reckoning of time in an extensive list of eight thousand solar, and fifty-two hundred lunar, eclipses which he is now preparing for publication.

It is difficult to see how this matter will finally be decided. It is evidently a question for astronomers to settle among themselves; but so far they seem to be very evenly divided. For instance: out of some twenty-seven astronomers whose opinions, more or less decided, have been accessible for a count, thirteen seem inclined to favor the proposed change, while fourteen are opposed to it. And among

[1] Die beschlüsse der Washingtoner meridianconferenz. St. Petersburg, 1885. 27 p. 8°.

the *pros* are Adams, Struve, and Christie; among the *cons*, Newcomb, Foerster, and Auwers.

W. C. W.

THE NATIVES OF AMERICA.[1]

THE native population (before the changes wrought by the European conquest) of the great continent of America, excluding the Eskimo, present, considering the vast extent of the country they inhabit, and the great differences of climate and other surrounding conditions, a remarkable similarity of essential characters, with much diversity of detail.

The construction of the numerous American languages, of which as many as twelve hundred have been distinguished, is said to point to unity of origin; as, though widely different in many respects, they are all, or nearly all, constructed on the same general grammatical principle, — that called polysynthesis, which differs from that of the languages of any of the old-world nations. The mental characteristics of all the American tribes have much that is in common; and the very different stages of culture to which they had attained at the time of the conquest, as that of the Incas and Aztecs, and the hunting and fishing tribes of the north and south, which have been quoted as evidence of diversities of race, were not greater than those between different nations of Europe — as Gauls and Germans on one hand, and Greeks and Romans on the other — in the time of Julius Cæsar. Yet all these were Aryans; and, in treating the Americans as one race, it is not intended that they are more closely allied than the different Aryan people of Europe and Asia. The best argument that can be used for the unity of the American race, using the word in a broad sense, is the great difficulty of forming any natural divisions founded upon physical characters. The important character of the hair does not differ throughout the whole continent. It is always straight and lank, long, and abundant on the scalp, but sparse elsewhere. The color of the skin is practically uniform, notwithstanding the enormous differences of climate under which many members of the group exist. In the features and cranium certain special modifications prevail in different districts, but the same forms appear at widely separated parts of the continent. I have examined skulls from Vancouver's Island, from Peru, and from Patagonia, which were almost undistinguishable from one another.

Naturalists who have admitted but three primary types of the human species have always found a difficulty with the Americans, hesitating between placing them with the Mongolian or so-called 'yellow' races, or elevating them to the rank of a primary group. Cuvier does not seem to have been able to settle this point to his own satisfaction, and leaves it an open question. Although the large majority of Americans have in the special form of the nasal bones, leading to the characteristic high bridge of the nose of the living face, in the well-developed superciliary ridge and retreating forehead, characters which distinguish them from the typical Asiatic Mongol, in many other respects they resemble them so much, that, although admitting the difficulties of the case, I am inclined to include them as aberrant members of the Mongolian type. It is, however, quite open to any one adopting the negro, Mongolian, and Caucasian as primary divisions, to place the American apart as a fourth.

Now that the high antiquity of man in America, perhaps as high as that which he has in Europe, has been discovered, the puzzling problem, from which part of the old world the people of America have sprung, has lost its significance. It is quite as likely that the people of Asia may have been derived from America, as the reverse. However this may be, the population of America had been, before the time of Columbus, practically isolated from the rest of the world, except at the extreme north. Such visits as those of the early Norsemen to the coasts of Greenland, Labrador, and Nova Scotia, or the possible accidental stranding of a canoe containing survivors of a voyage across the Pacific or the Atlantic, can have no appreciable effect upon the characteristics of the people. It is difficult, therefore, to look upon the anomalous and special characters of the American people as the effects of crossing, as was suggested in the case of the Australians, — a consideration which gives more weight to the view of treating them as a distinct primary division.

[1] Extract from the address of Prof. W. H. FLOWER as president of the Anthropological Institute of Great Britain.

CLAUS'S TEXT-BOOK OF ZOÖLOGY.

IT is an interesting and sad fact that England and America have not as yet produced one really good manual of zoölogy, while Germany has at least two of the first order. One of these, Professor Claus's 'Grundzüge der zoologie,' has reached its fourth edition, with every probability that a fifth will soon follow. The last edition contains about fourteen hundred pages. Its large size makes it unwieldy for the beginner, and, moreover, there are no figures. By shortening especially the descriptions of orders and families, and some further condensation, the book was reduced to about eight hundred pages, and space saved for about the same number of figures. The new book thus formed is the 'Lehrbuch der zoologie,' translated under the above title. In all Professor Claus's writings, one cannot fail to notice his judicial fairness. The discussion of Darwinism (vol. i. pp. 139–179) is especially remarkable for its impartiality and candor, as well as its clearness and condensation. The arrangement of material in the general part, and the descriptions of the types, show the comprehensiveness of his mind and the extensiveness of his knowledge, while his exact-

Elementary text-book of zoölogy. By Dr. C. CLAUS and ADAM SEDGWICK, with the assistance of F. G. HEATHCOTE. 2 vols. New York, *Macmillan*, 1885. 8°.

ness in details is as clearly apparent in every one of the sharp and terse definitions. These present the few characteristics which apply to the whole group, and only that group, rarely extend beyond three lines, and are expressed in words as well chosen as the characteristics themselves. As the student follows them from type to family, he sees clearly that the animal kingdom is really a cosmos, not the chaos which is presented in too many of our zoölogies. Under each type, class, and order, each organic system, the embryonic development, and the habits of the group are described in the same clear, brief terms. Thus one can study the fourteen hundred pages of the 'Grundzüge,' or the eight hundred of the 'Lehrbuch,' and scarcely erase five words to a page, or condense in any way the sentences, without entirely changing their meaning. How many thorns would be removed from the path of the working zoölogist if all our writers could borrow Professor Claus's sharpness of vision, and accuracy of description!

The general part of the work covers a hundred and eighty pages. Of these, a hundred and thirty are devoted to the general qualities of protoplasm, the structure and development of cells and tissues, the general anatomy and physiology of each 'compound organ,' and embryonic development. The next fifty pages contain in brief outline the history of the science, and the discussion of the theory of evolution. This is, unlike most zoölogies, perhaps the most interesting and striking portion of the book, especially as in this part the genius of the author, in the choice and arrangement of material, is the plainer because of the greater liberty here possible. As specially interesting, might be noticed the author's views of parthenogenesis (p. 106) as a reproduction, on the part of agamic females by true eggs, "by no means to be relegated to the category of germ-cells,"—views quite opposed to the quotations from English writers so common in our American literature, although Professor Claus seemed to be supported by Balfour and a majority of the German school.

Under Protozoa in the special part, the Monera are disregarded as a separate group, and merged with Rhizopoda and Flagellata. Thus neither nucleus nor pulsating vesicle is considered a necessary characteristic of Rhizopoda. The Flagellata are provisionally classed under the Infusoria, with expressed doubts of their animal character. Among the Flagellata are reckoned the Astasiadae (Euglena) and the Volvocinidae, although the close alliance of the latter family to the Algae is clearly acknowledged. In an appendix to the Protozoa, the Bacteria and Gregarinidae are briefly considered. It is an open question whether this is an improvement on the arrangement of forms in the 'Grundzüge,' where Bacteria, Flagellata, Myxomycetes, Catallacta, and Labyrinthuleae are all discussed in connection with Protozoa, but as groups of very doubtful position and affinities.

The study of the Coelenterata is introduced by a description of the three individual types, polyp, medusa, and ctenophore. The discussion of their resemblances and differences brings the different forms of this group clearly before the student at the outset, beside furnishing him a basis for their classification. The sponges are considered as merely a subgroup of Coelenterata.

On account of its embryonic development, Balanoglossus is assigned to an appendix at the end of the echinoderms.

Under Vermes the Nemertini are still retained with the Platyhelminthes. The Gephyrea are placed between the Chaetopoda and Hirudinea as the second sub-class of Annelida, while the Rotatoria form the fourth and last class of Vermes. This is certainly an extremely practical classification, even though some might prefer to consider the Rotatoria earlier in the series of worm-forms, on account of their general affinities.

The second volume contains, 1°, Mollusca; 2°, Molluscoidea, to which are reckoned only Polyzoa and Brachiopoda as possessing strong affinities to annelids as well as Mollusca; 3°, Tunicata; and, 4°, Vertebrata. Thus over five hundred pages of the two volumes are devoted to Invertebrata. The seven hundred figures are well chosen, and far above the average in beauty and clearness. Under every type and class are references to the latest and best literature on the subject. The translator has had a difficult task. It is no easy matter to translate into idiomatic English the author's condensed and pregnant sentences, where every word is important. A few cases might be noticed where the rendering of single words might be improved; but, as far as can be judged from a careful comparison of about thirty pages taken at random through the work, even such cases are rare, and in general the translation certainly gives a very just rendering of the author's ideas.

The publishers have given us a good page and paper, and clear type. Altogether, it is the only really satisfactory manual which we have in English, and one which no teacher or student of zoölogy can afford not to possess.

TROMHOLT'S UNDER THE RAYS OF THE AURORA BOREALIS.

'WENN jemand eine reise thuht, so kann er was erzählen,'—it must have been with this text that Tromholt sat down to write the story of his life in Lapland. He was there to study the aurora borealis; but not content with doing a goodly amount of work, and doubtless setting the results down in awe-inspiring columns of figures, he devoted a part of his time to trips to Lapp encampments near his observing station at Koutokaeino, a more extended one to the Finnish station at Sorlankyla, and another along the north coast to Boris Glebe on the Russian boundary.

FIG. 1.—NORWEGIAN CIRCUMPOLAR STATION AT BOSSEKOP.

As a Scandinavian, he may well be proud of the scenery of southern Norway, which he refers to in the opening chapter. He says, "Dig a canal right through Switzerland, and steam down it: that would give some idea of the voyage along the coast of Helgeland, Lofodden, and Finnemarken." It may be even unjust to refer to Norwegian waters as canals, but still most will catch the author's meaning.

Bossekop was the name of the place where Tromholt and his party finally left the steamer which had brought him from Bergen. This hamlet is north of the arctic circle, and lies at the head of the Alten Fiord. We are somewhat surprised at our author's statement that Bossekop is surrounded by green hills with soft outlines, as most northern landscapes remind one strongly of the top of Mount Washington; and we are not much re-assured by the picture given of the place, which shows the usual assortment of barren boat-houses, and the trader's house and stores. One frame-house and its adjuncts constitute a hamlet in Norway.

It was in June, 1882, the party landed, and began the preparations for their series of observations, which were to be continued from Aug. 1, 1882, for one year. The description given of the routine at the station is not of such a character as to lead one to be anxious to emulate the work of such explorers. To sit blinking by the fire, waiting for the appointed hour, and then to venture out with a cup of hot water for the wet-bulb thermometer, in one hand, and an oil-lamp in the other, to spend a few minutes reading the thermometer and barometer, and sketching the aurora, and roughly measuring its position; and to return to the fireside, at last, with nearly frost-bitten fingers and a frozen lamp no longer burning,—this surely is not an alluring existence. But hour after hour the operation was gone through with, first by one, and then by another, of the party.

Tromholt himself left the main party at Bossekop, and travelled south about 63 miles to Koutokaeino. His reason for doing this was, that, by observations at the two stations

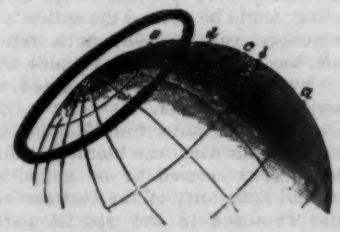

FIG. 2.—TROMHOLT'S THEORY OF AN AURORAL RING.

of the same auroral arch, some estimate might be formed of the height at which the auroral light is formed.

In a chapter of ninety odd pages, Tromholt reviews the theories of the aurora, classifies as best he can the different phenomena connected with them, and gives his own ideas in regard to what is actually going on when we see a

Under the rays of the aurora borealis: In the land of the Lapps and Kvaens. By SOPHUS TROMHOLT. 2 vols. London, *Low*, 1885.

display of northern lights. A number of illustrations are given; but in all cases they are reproduced from drawings, as, even with the most sensitive plates, he utterly failed in getting any impression on a negative. He holds the opinion that the fundamental phenomenon is a ring of light encircling the earth, as shown in fig. 2, and that all the various forms observed are due to modifications and imperfections in this ring. To the streamers he gives the position which a dipping-needle would take, and explains their apparent coming-together at the magnetic zenith, as they do occasionally, as

of 1883 to the Finnish polar station, Tromholt takes occasion to criticise the artificial aurora which Professor Lemström succeeded in getting on the top of a hill. He thinks the light more of the nature of St. Elmo's fire than a true aurora. He also takes exception to Lemström's determinations of the height.

Koutokaeino was the seat of a religious excitement among the Lapps, which finally culminated in 1852 in the murder of the trader and sheriff of the place, the pastor's life being saved only by the timely advent of a few armed and sane Lapps from a neighboring vil-

Fig. 3.—Tromholt's auroral station at Koutokaeino.

due to perspective. He believes in such cases that the observer is looking into a tube of rays.

The geographical distribution of the aurora is described, and the results of the various estimates of the height given, Tromholt's own measurements making the average height of the lower edge of a number of auroral arches 70.2 miles. The connection of the aurora with the sun-spot periods is referred to, and a bi-yearly variation in the phenomenon is made probable. The crackling sound sometimes said to have been heard, Tromholt was led to consider imaginary. As regards the strength of the light emitted, he says that at times he was able to read print of the following size:—

Aurora borealis.

In the account of his journey in the spring

lage. A somewhat similar excitement was in 1883 brewing at Hätta to the east of Koutokaeino.

The most of Tromholt's trips over the country were made in reindeer-sleds, when the snow was hard, and were accomplished with few more than the usual mishaps of such travelling, although his St. Bernard dog, Rolf, did not prove a congenial companion for the deer. But the final journey, to Sodankyla, was made when the sun had already begun to melt the snow; and, on his return, Tromholt pictures himself as dragged through from one to two feet of water for a great part of the way. In the spring the land must resemble one vast mud-puddle. Finally Tromholt returned to civilization, and took his voyage along the north coast of Scandinavia.

Thanks to the cheap photo-engraving pro-

cesses employed, the book is well supplied with authentic illustrations, although some of them are not very clear, — a fault doubtless due to imperfections in the original photographs.

SOME STATE GEOLOGICAL REPORTS.

MINNESOTA is not only the centre, but it is also the summit of the continent, in the sense of being the starting-point of the three most important systems of drainage in North America. But, notwithstanding its geographic position, the mean altitude of the state is less than thirteen hundred feet, and its surface configuration presents the simplicity and monotony of a level and thoroughly glaciated region; while the geological structure of the greater portion of the state is hopelessly buried under a thick and almost unbroken mantle of drift. These circumstances greatly diminish the labors of the geologist; and it is at first a matter of surprise that ten years should have elapsed between the inception of the survey and the completion of this first volume of the final report. But this is readily explained by the very economical administration of the survey, the geological corps consisting of the director and one assistant, and, during a considerable part of the time represented by this volume, of the director alone.

The introductory chapter is an extended and admirable historical sketch of explorations and surveys in Minnesota and the adjacent states, from the times of Champlain, Duluth, Hennepin, and LA SALLE, to the present survey. This historical introduction is, in its extent and general interest, unique among American geological reports. It is illustrated by several good reductions of the earlier maps of the north-west, and must prove a valuable compilation to students of history and geography as well as of geology. The account of the general physical features of the state in this volume is brief, and yet adequate, considering the topographic uniformity. But we look in vain for any generalized statement of the geological formations of the state below the drift. It is probable, however, that this chapter is reserved for a later volume; for, as stated in the preface, this volume is intended to be mainly descriptive, — a repository of facts, with only such generalizations as are self-evident or generally admitted.

The geology of Minnesota. Vol. I. of the final report. By N. H. WINCHELL, assisted by WARREN UPHAM. Minneapolis, *State*, 1884. 13+697 p., 1+31 pl. 4°.

Indiana. Department of geology and natural history. Twelfth and thirteenth annual reports. JOHN COLLETT, state geologist. Indianapolis, *State*, 1883, 1884. 400 p., 38 pl. (4) maps; 16+186 p., 30 pl., map. 8°.

The popular demand for early practical results is well met in the excellent chapter on the building-stones, which constitute, at present, the most important field of the economic geologist. The descriptions are plain and simple, with the condensed statements of the microscopic characters in fine print. The use of 'syenite' as a name for hornblendic granite is, however, antiquated, and without the sanction of the leading lithologists of this country and Europe. The table in which the descriptions of forty-one of the most important building-stones are condensed and compared would be a model of its kind, if the mineralogical composition of the stones were included. It shows at a glance, that, in crushing-strength and durability, the building-stones of Minnesota are probably not surpassed by those of any state in the Union.

The main part of this volume (about five hundred pages) is devoted to detailed accounts of the geology of the state by counties. Of the eighty counties in the state, twenty-eight, including nearly all that part of the state south of the Minnesota River, are here mapped and described, two-thirds of this work being credited to Mr. Upham. In some instances the descriptions of several counties have been combined; and, if this plan had been more generally adopted, much needless repetition might have been avoided, and the monotony of this part of the volume greatly relieved.

The two annual reports of the state geologist of Indiana contain comparatively little in the way of original contributions to the geology or natural history of the state. The most important sections of the reports are those on the paleozoic corals, and the subcarboniferous fossils of Spergen Hill, by Professor James Hall; the paleozoic flora, by Professor Lesquereux; and the fauna of the Indiana coal-measures, by Dr. C. A. White. These papers consist of short specific descriptions, with seventy-one plates of figures. Very few of the species are new to science, or peculiar to Indiana, while a considerable number are not found in that state. These articles are really compilations from the reports of other states and more general sources; and, although doubtless of some value as reference-manuals of the paleozoic fauna and flora, it is a question to what extent such publications are really germane to the purposes of a geological survey. Each volume contains several short county reports, and in these and other chapters the economic features have special prominence. But the treatment is not always impartial, for there is a manifest tendency in some parts to

unduly extol the good features of the state and the importance of the geological survey. The report for 1882 contains a catalogue of the flora (789 species) of the Alpine or central-eastern portion of the state.

NOTES AND NEWS.

In an appendix to Professor Dexter's 'Biographical sketches of the graduates of Yale college,' Prof. H. A. Newton has given some figures showing the mortality among the graduates of the early years of the college. The graduates considered are those of the years 1702–44, 488 in all. To avoid irregularities, the results have been grouped in sets of ten years. The actual numbers of deaths are compared with the numbers computed from the American and combined experience tables.

Table showing the mortality, actual and expected, by decades of years, among Yale graduates, 1702–44.

Ages.	No. of deaths.	Mortality by American table.	Mortality by combined experience table.
14 to 25	29	18.69	17.64
26 to 35	41	36.03	38.17
36 to 45	48	37.73	40.12
46 to 55	71	44.87	54.02
56 to 65	93	68.17	77.02
66 to 75	99	93.52	97.72
76 to 85	46	83.40	79.93
86 to 95	27	51.31	87.72
96 to 102	2	–	–
Total.	473	435.03	440.34

The most noticeable fact shown by this table is that below the age of seventy the actual mortality so largely exceeded the tabular, the excess being over twenty per cent of the expected mortality. This mortality experience is decidedly different from that of the persons who have been members of the Divinity school of Yale college (*New-Englander*, April, 1873). For them, between the ages of forty and seventy, the tabular *exceeded* the actual mortality by nearly forty per cent of the former. This enormous difference is quite uniformly distributed, and is evidently not principally due to chance. It cannot be due to great difference in the two groups of men. It must rather be ascribed to a difference in the habits of living in the eighteenth and nineteenth centuries.

— It appears from *Nature* that preparation is already making for the meeting of the British association in Birmingham in 1886. It is stated that the meeting will probably be under the presidency of Sir William Dawson of Montreal.

— Dr. Andrée of Leipzig, according to *Nature*, discussed before a recent meeting of the Anthropological society of Vienna the question whether iron was known in America in pre-Columbian times. Meteoric iron was certainly in use amongst certain Indian tribes and the Eskimo, but Dr. Andrée thinks that they were wholly unacquainted with the art of forging iron. This conclusion is based on the fact, among others, that while there is ample proof that the Indians [the author under this term is including the Mexicans and Peruvians] knew how to obtain and employ gold, silver, tin, copper, quicksilver, etc., we hear nothing of iron-mines in the history of the civilization of ancient America. The language itself proves this, for there is no expression for *iron*. Some writers, it is true, speak of the word *panilgue* as that for iron, but it really means metal in general. Moreover, in prehistoric, or rather pre-Columbian, graves, especially in the rainless regions of Peru and northern Chili, ornaments of all kinds, weapons, and implements are found; but no objects in iron have been discovered, although the Indians placed their most valued articles in their tombs. [Meteoric iron has, however, been found in several mounds in Ohio by Mr. F. W. Putnam of the Peabody museum in Cambridge, both in a natural state and hammered; in the latter form used for the same purposes as native copper, both for implements and ornaments.] Dr. Andrée thinks there is no reason to believe that the tools employed in the great masonry-works of Peru, such as that at Tiahuanaco, were other than those in use in the rest of Peru, which were of *champi*, a species of bronze. The chisels found in Peruvian graves soon become blunted when used on the hard strut; but it is suggested that there was some method of sharpening them easily. Indians certainly have worked a hard stone like nephrite without iron; and there is no improbability, says the writer, in the theory that these chisels were employed, when we recollect the patient temperament of the Indians, who for generations were accustomed to the repetition of the same work, to indolently pursuing a uniform task, and also that *gutta cavat lapidem*.

— Dr. G. A. Fischer, in his proposed journey to Lado on the upper Nile, will start, according to the *Athenæum*, from Pangani, and endeavor to open up a direct route to Speke Gulf. His movements after arriving in Uganda will depend upon circumstances. It is just possible, that, owing to the proceedings of a German colonization society, Dr. Fischer may not find it easy to recruit carriers at Zanzibar. In a paper which he read at the German geographical congress at Hamburg, Dr. Fischer spoke sensibly against some of the utopian schemes of his countrymen. He pointed out more especially that Europeans cannot become acclimatized in equatorial Africa, except perhaps at an altitude of more than five thousand feet, and that even the interior tablelands are free from malaria only where they are barren, and consequently useless for purposes of colonization.

— Twenty-three maps, fourteen by seventeen centimetres, of excellent execution, clear and not overcrowded lettering, form a most convenient pocket atlas, the twenty-first edition of which, entirely remodelled, has just been issued from the geographical establishment of Justus Perthes in Gotha. For a European tourist, nothing could be more convenient, as more than half the maps relate to that continent, and only three to North America and the United States

— The Parker memorial science class of some seventy members has just closed its course of weekly lectures or lessons. These were of a very varied character, being given by some twenty-five persons on successive Sundays, on a great variety of topics. The enterprise of the promoters in securing in many cases excellent speakers is to be commended; but one fails to see any harmony in the general plan, and can therefore only question its utility, beyond satisfying a dyspeptic craving for miscellaneous information.

— An international pharmaceutical congress is to be held in Brussels from Aug. 31 to Sept. 6. The principal subjects of discussion are to be: 1. An international pharmacopeia; 2. Pharmaceutical education; 3. Adulteration of food; 4. Drinking-water and its properties and circumstances. The language used will be French, and the king of the Belgians will be president of the congress.

— On the 4th of July, 1883, during the voyage from Lisbon to Plymouth, a bottle containing a paper was thrown overboard from the German gunboat Cyclop in latitude 39° 41.8′ north, and longitude 9° 41′ west. This was afterwards picked up on the 1st of March, 1885, on the east side of Grand Turk Island, West Indies. This bottle had been afloat one year and eight months, and had probably travelled back and forth in the North African and north equatorial currents. Through the German embassy in Portugal the German seewarte has received a bottle-post paper which was put overboard on the 4th of December, 1884, by the German bark Nubia during a voyage from Rotterdam to Zanzibar, in latitude 16° 13′ north, longitude 21° 53′ west. This was afterwards picked up near Sal Island, Cape de Verdes, in about latitude 16° 52′ north, and longitude 22° 55′ west. The date of the finding of the bottle was not given. The paper was handed to the German consul at Sal Island by the harbor authorities of that place on the 1st of March, 1885. It is likely that this bottle travelled about 70 sea-miles N.W. by W. ½ W. in 2½ months. It is also probable that it lay ashore for some time before it was found, or that considerable time elapsed before the paper was delivered to the German consul. Through the German consulate in Rochefort, France, the same institution has received a bottle-post paper which was put overboard from the German schooner Milly, July 25, 1884, during the voyage from Hamburg to the Marshall Islands, in latitude 48° 18′ north, longitude 6° 48′ west. This was afterwards picked up on the coast on the 14th of February, 1885, in latitude 46° 27′ north, longitude 2° 42′ west. It is probable that this bottle travelled 202 sea-miles S.E. by E. in 204 days. The seewarte has also received a bottle-post paper from Corpus Christi, Tex., which had been put overboard from the German steamer Kronprinz Friedrich Wilhelm, Dec. 26, 1882, in latitude 1° 37′ north, longitude 30° 43′ west. This was afterwards picked up on the 1st of June, 1884, near Padre Island, coast of Texas, in about 27° north latitude, 97° 15′ west longitude. This bottle had probably travelled 4,100 sea-miles W.N.W ½ W. in 523 days.

— Dr. Bernard Schwartz has written a painstaking work on the history of mountain investigation from ancient times to the days of De Saussure ('Die erschliessung der gebirge,' Leipzig, 1885), based on his lectures at the Freiberg mining school. It carries the reader through the early centuries of travel in rugged countries, when mountains were merely obstacles, not objects, in the road; through the middle centuries, when attention to nature was awakening, but when observation was still so uncritical that Teneriffe, for example, was reported nine miles, and even fifteen miles high; and into the modern era, which, so far as accurate measures of altitude are concerned, began in the famous meridian-arc expedition of Bouguer and La Condamine to Peru in 1735. Up to this time Mont Blanc was the 'monarch of mountains,' just as the Alps were the mountains, *par excellence*, of the world; but then Chimborazo took the lead, and held it till 1818, when the English explorations brought the peaks of the Himalaya up to the first rank. The progress and results of mountain exploration are thus minutely chronicled in about five hundred pages, themselves almost pathless, as the table of contents is very brief, and index, page-headings, and paragraph-headings are quite wanting.

— Professor Nowacki of the Polytechnic institute in Zurich has prepared an introduction to the study of soils ('Kurze anleitung zur einfachen bodenuntersuchung,' Zurich, 1885), from which we may measure the attention given to scientific agriculture in Switzerland. It gives a general statement of the structure of soils, and of the method of taking samples, and then proceeds to treat the analysis and classification of soils more at length, and to discuss the determination and supply of needful elements. It is all treated as simply as possible, so as not to be too inaccessible to those who have most need of its teachings. A supplement, however, gives 'the first attempt at a scientific terminology of soils,' which we fear will not soon enter into common use. Seven genera, of six species each, from Terra rudecta limosa aut margillosa to Terra humosa agrestis et hortensis, is at least somewhat cumbersome.

— An extended list of altitudes for nearly three thousand places in the Carnic and Julian Alps has lately been compiled by G. Marinelli, professor of geography in the University of Padua, and published as a supplement to the *Cosmos* of Guido Cora of Turin. It is preceded by a list of a hundred and nineteen authorities, forming in itself a guide to the geographic literature of the region, and is introduced by a well-analyzed table of contents, from which any desired point can easily be found.

— Dr. G. M. Dawson has recently discovered a remarkable Jurasso-cretaceous flora in the Rocky Mountains, on the branches of the Old Man River, Martin Creek, Coal Creek, and one other locality far to the north-west on the Suskwa River. The containing rocks are sandstones, shales, and conglomerates, with seams of coal, in some places anthracite. It was proposed by Sir William Dawson, in his paper before the recent meeting of the Royal society of Canada, to call

these beds the Kootanie group, from a tribe of Indians who hunted over that part of the Rocky Mountains between the 49th and 52d parallels. The beds lie in troughs in the paleozoic formations of the mountains, and may be traced for a distance of a hundred and forty miles north and south. The plants found are conifers, cycads, and ferns, the cycads being especially abundant. Some are identical with species described by Heer from the Jurassic of Siberia, while others occur in the lower cretaceous of Greenland. No dictoyledonous leaves have been found in these beds, which connect in a remarkable way the extinct floras of Asia and America and those of the Jurassic and cretaceous periods.

— In an article on the variations of personality, in the *Journal de Genève*, Dr. Hermann Fol mentions three elements of personality, — consciouaness, memory, and volition. Of the first there are several kinds, notably consciousness of sensation, where the sensation proper must be distinguished from our consciousness of it. If the latter is lost periodically, and the condition alternates at regular intervals with the normal state, a sense of double existence is produced; and the same state arises when consciousness of sensation is carried to an extreme. In regard to the memory, a person sometimes seems to have two distinct memories which act alternately. The duplication is particularly noticeable in the case of somnambulists. If it occurs in a state of wakefulness, the person seems to have two distinct personalities. Only the normal memory forms an element of the personality. The personality may also be altered by a change in our idea of the future. Absent-mindedness, and yielding to involuntary impulses, are the outward signs of this kind of mental disease. In conclusion, Dr. Fol thought men differed less in the extent of their faculties than in the extent of their consciousness of them.

— An aeronautical exhibition under the patronage of the Aeronautical society of Great Britain was to be opened, says *Nature*, during the present month, in connection with the International exhibition at the Alexandra palace. The large out-door space will be made available for various competitions. The disputed question of aerial locomotion by the aid of buoyancy will be tested. Possibly the fire in the building in the early part of June may interfere with the plans.

— A course of ten lectures on the practical analysis of plants was finished on June 20 at the Cincinnati society's rooms. They were given by Jos. F. James, and were instituted for the special benefit of the teachers in the public schools. They were free to those invited, and were attended by from fifteen to twenty teachers. The society proposes to give similar courses of lectures on Saturday mornings in the fall. The first one will probably be on physiology and hygiene, followed by one on physical geography.

— We regret to notice the death of Rev. T. W. Webb at Hardwick, Eng., on the 19th of May. He is known everywhere to astronomers, to amateur astronomers in particular, as the author of 'Celestial objects for common telescopes,' — a book which is said to have "done more to interest observers in the heavens than any other book that has been published." He was a frequent contributor to *Nature*, the *Intellectual observer*, the *English mechanic*, etc. One of his most recent works was a popular book on the sun. We learn from the *Astronomical register* that he was appointed a prebendary of Hereford Cathedral in 1882; and, if he had lived a few weeks longer, he would have completed his eightieth year.

— Entomologists will be sorry to learn of the death, on the 15th inst., at his home in Morgantown, N.C., of Mr. H. K. Morrison, a noted collector of insects, probably the most successful and enthusiastic in this line of any we have had. A large proportion of his collections went to Europe, where they were eagerly sought; and the literature of descriptive entomology for the last ten years in this country shows everywhere the indications of his zeal.

— A correspondent of the *English mechanic*, writing from Morchain, Somme, France, says, "A boiler of a new system, which received the name of *générateur tricyclique inexplosible*, has been invented, which differs from all those hitherto produced. The metallic surface submitted to the action of the fire does not touch the water; in no condition can the boiler get red-hot; it is enveloped all over by the same temperature: hence an immense vaporization; and steam can be produced to the very last drop of water without the least danger."

— Jules Garnier has designed an elevated railway for the city of Paris, which it is expected will be in running order in time for the exposition of 1889. It will be twenty-eight thousand eight hundred metres (about eighteen miles) in length, and will cost ten millions of dollars. The structure will be composed of two tracks, one above the other, on an iron frame. The whole will be fifteen metres from the building-line, and vibrations will be guarded against by special appliances. The trains will be composed of three American cars, each fourteen metres in length, and two platform or open cars. They will run every five minutes for seventeen hours each day, and will have branches connecting with the several railway-stations.

— A new volume of memoirs of the Siberian section of the Russian geographical society contains a description of Lake Balkhash by Fischer, an account of the Vassiugan tundras, a list of geographical positions determined by Lebedeff, and other documents of importance.

— Vesque's 'Traité de botanique' (Paris, *Baillière*), which was written, as the author states, as supplementary to lectures delivered at the Institut agronomique, is prefaced by a brief review of the characters of classificatory value in botany, but is in the main a concise synopsis of the phenogamic orders of importance. The scientific reputation of its author is a sufficient guaranty of its accuracy; and the information it contains is rendered easily accessible by a complete index to the illustrations and specific descriptions, and to the principal products mentioned.


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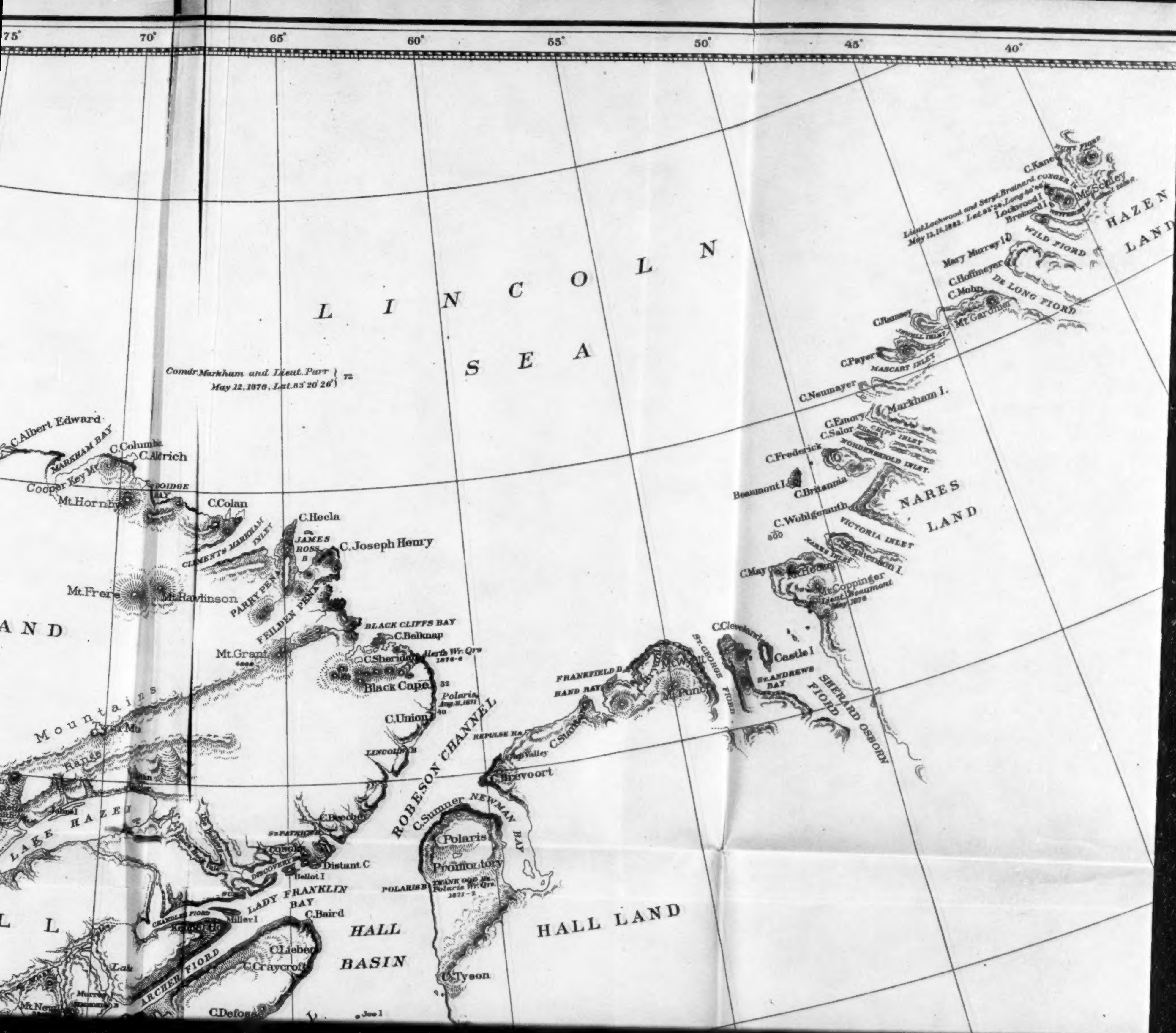

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C.Hoffmeyer
DE LONG FIORD
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Mt Gardiner
C.Ramsay
C.Payer
MASCART INLET
C.Neumayer
Markham I.
C.Emory
C.Salor
CHIPP INLET
C.Frederick
NORDENSKIOLD INLET
Beaumont I.
C.Britannia
NARES LAND
C.Wohlgemuth
VICTORIA INLET
Stephenson I.
C.May
Mt Coppinger
C.Cleveland
Castle I
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SHERARD OSBORN FIORD
St GEORGE FIORD
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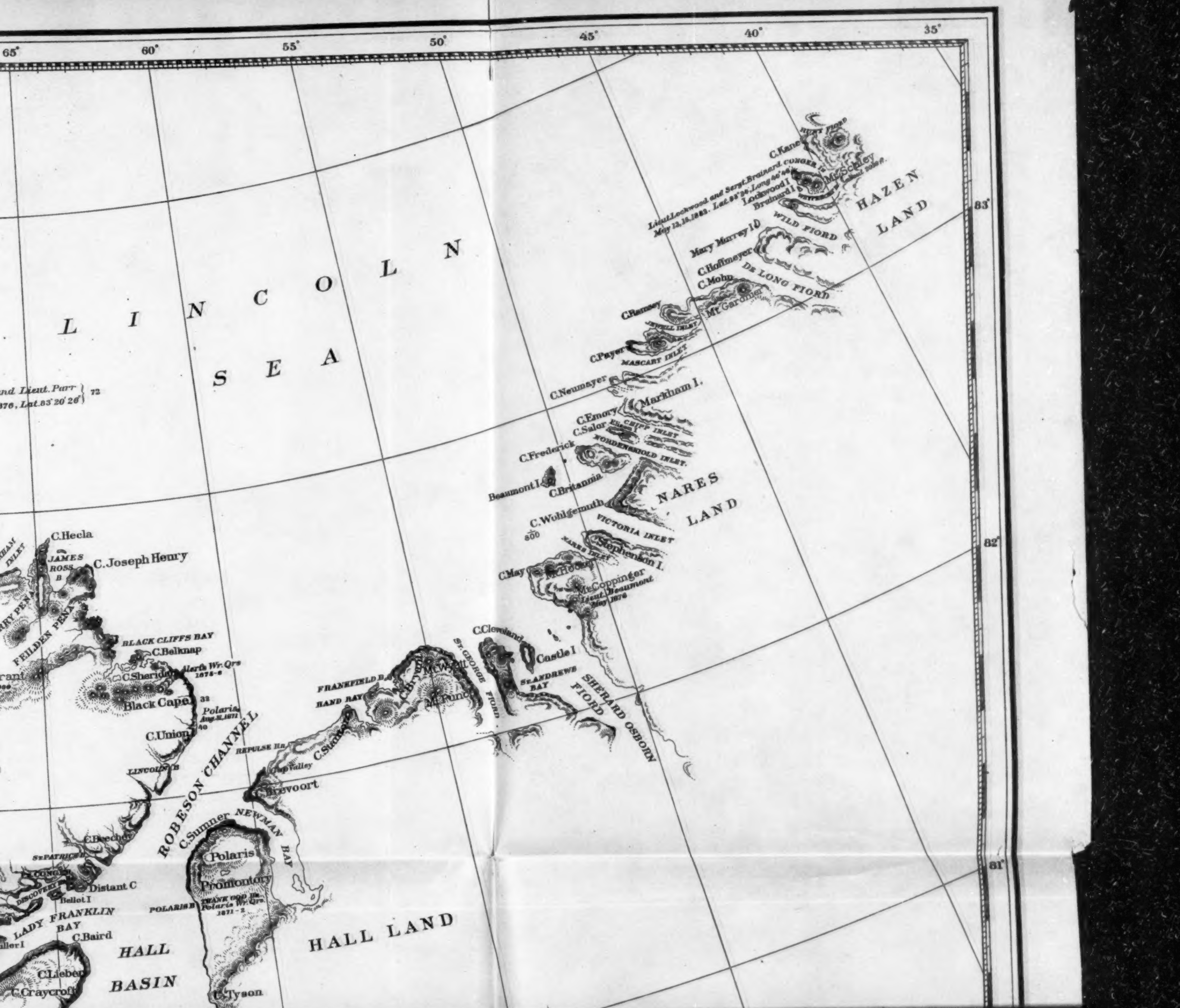
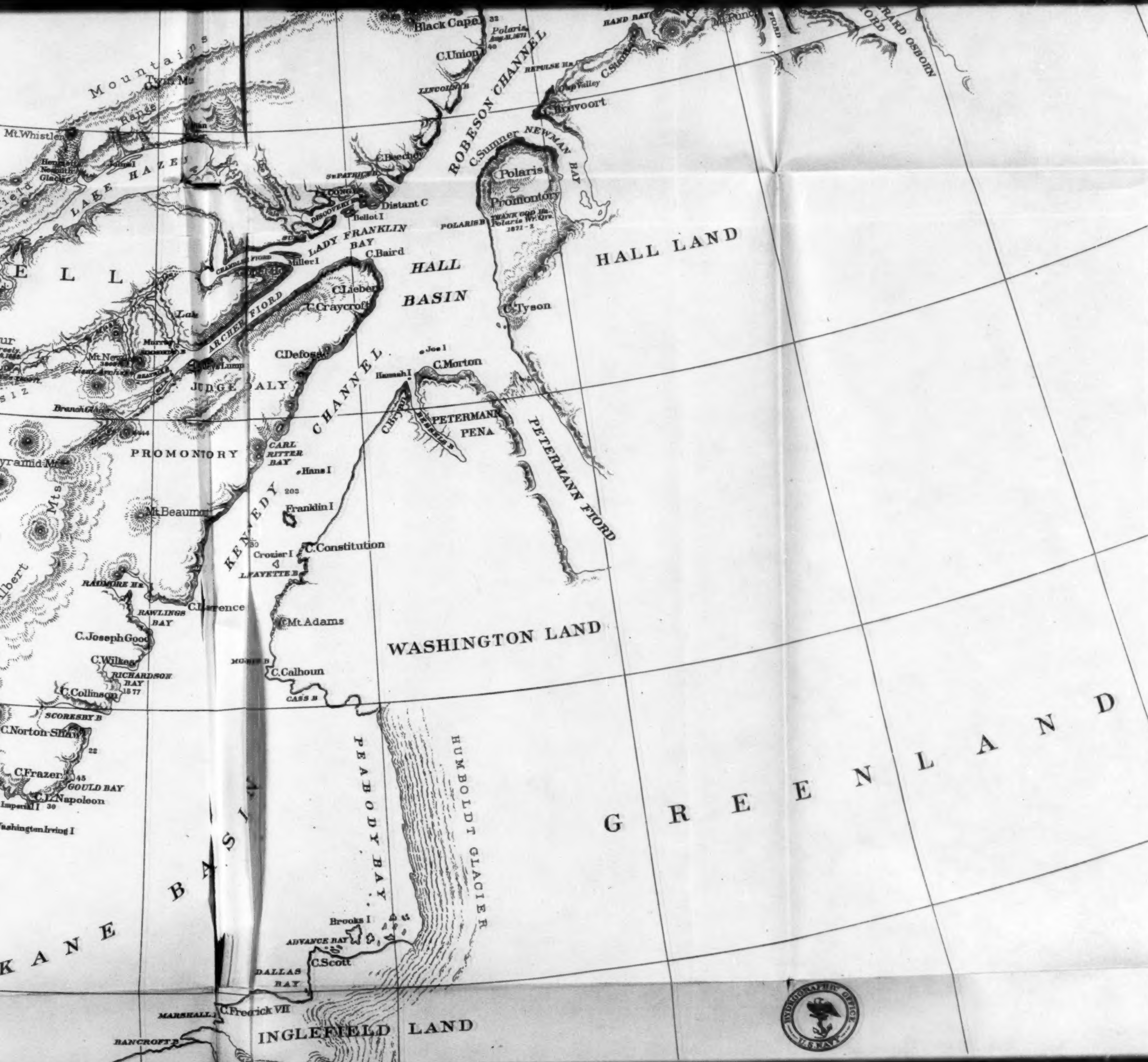
C.Joseph Henry
CLEMENTS MARKHAM INLET
Mt.Frere
Mt.Rawlinson
PARRY PEN
FEILDEN PENA
BLACK CLIFFS BAY
C.Belknap
C.Sheridan
Alert Wr. Qrs 1875-6
Mt.Grant
Black Cape
Polaris Aug.31,1871
C.Union
LINCOLN B
ROBESON CHANNEL
REPULSE Ha.
C.Brevoort
C.Sumner
NEWMAN BAY
Polaris Promontory
POLARIS B
THANK GOD Ha. Polaris Wr. Qrs. 1871-2
HALL LAND
HALL BASIN
C.Tyson
C.Beechey
Distant C
Bellot I
DISCOVERY
LADY FRANKLIN BAY
C.Baird
Miller I
C.Lieber
C.Craycroft
ARCHER FIORD
C.Defosse
Joe I
LAKE HAZEN
Mountains
Range
AND
L L


95°
90°
85°
80°
75°
70°
65°
C.Alexandra
Ward Hunt I
C.Albert Edward
C.Columbia
C.Aldrich
Mt.CLINTOCK
AYLES BAY
C.Bicknor
DISRAELI BAY
MARKHAM BAY
Cooper Key Mt
BOIDGE BAY
Mt.Hornby
C.Colan
Mountains
MILES BAY
CLEMENTS MARKHAM INLET
Lieut. Aldrich May 1876
YELVERTON BAY
Challenger
C.Alfred Ernest
GRANT LAND
Mt.Frere
Mt.Rawlinson
PARRY PEN
FEILDEN PEN
Mt.Grant
Mountains
Mt.Whistler
GARFIELD
United States
LAKE HAZEN
COAST
Garfield
Mt.Connell
Mt.Biederbick
GRINNELL
Conger Mts
Miller I
LADY FRA
C.Craycroft
Comdr Markham and Lieut. Pa
May 12, 1876, Lat 83° 20'



65°
60°
55°
50°
45°
40°
35°
83°
82°
81°
LINCOLN SEA
HAZEN LAND
NARES LAND
HALL LAND
HALL BASIN
ROBESON CHANNEL
NEWMAN BAY
LADY FRANKLIN BAY
C. Kane
Lockwood I.
Brainard I.
Mt. Schley
WILD FIORD
Mary Murray I.
C. Hoffmeyer
C. Mohn
DE LONG FIORD
Mt. Gardner
C. Ramsay
C. Payer
MASCART INLET
C. Neumayer
Markham I.
C. Emory
C. Salor
C. Frederick
Beaumont I.
C. Britannia
C. Wohlgemuth
VICTORIA INLET
Stephenson I.
C. May
Mt. Coppinger
Lieut. Beaumont May 1876
C. Cleveland
Castle I.
St. GEORGE FIORD
St. ANDREWS BAY
SHERARD OSBORN FIORD
FRANKFIELD B.
BAND BAY
REPULSE Hr.
C. Sumner
C. Brevoort
C. Hecla
JAMES ROSS B.
C. Joseph Henry
FEILDEN PENA.
BLACK CLIFFS BAY
C. Belknap
C. Sheridan
Alert Wr. Qrs 1875-6
Black Cape
Polaris Aug. 31, 1871
C. Union
LINCOLN B.
C. Beechey
Distant C.
Bellot I.
C. Baird
C. Lieber
C. Craycroft
Polaris Promontory
THANK GOD Hr.
Polaris Wr. Qrs. 1871-2
POLARIS B.
C. Tyson


GARFIELD COAST
United States
Mt.Whistler
Garfield
Mt.Connell
Mt.Biederbick
Conger Mts.
Mt.Arthur
Lake
Outlet of Glacier
GREELY FIORD
AGASSIZ
Lieut.Lockwood
Sergt.Brainard
May 13, 18, 1883.
C.Brainard
MER DE GLACE
Pyramid Mts
LAND
C.Lockwood
Fiord or Channel
Victoria and Albert
81°
80°
79°
ARTHUR LAND
DOBBIN BAY
C.Frazer
Pr.Imperial I
John Evans Glacier
C.Hawks
ALLMAN B
WOODWARD BAY
C.Harrison
Walrus Shl
Norman Lockyer I
PRINCESS MARIE BAY
C.Baker
SCHLEY LAND
C.Long
Bache I.
C.Albert
HAYES SOUND
C.Camperdown
C.Israel
Weyprecht Is
Mt.Carey
BUCHANAN STR
Islands
Cocked Hat I
C.Sabine
ELLESMERE
Mountains



Black Cape
Polaris
C.Union
LINCOLN B
ROBESON CHANNEL
REPULSE H
Brevoort
C.Sumner
NEWMAN BAY
Polaris
Promontory
BAND BAY
OSBORN
FIORD
Mountains
Mt.Whistler
LAKE HAZEN
C.Beechey
Distant C
Bellot I
LADY FRANKLIN BAY
C.Baird
POLARIS B
HALL LAND
HALL BASIN
C.Lieber
C.Craycroft
C.Tyson
ARCHER FIORD
C.Defosse
Joe I
C.Morton
Hannah I
JUDGE DALY
CHANNEL
PETERMANN PENA
PETERMANN FIORD
PROMONTORY
CARL RITTER BAY
Hans I
Mt.Beaumont
KENNEDY
Franklin I
C.Constitution
Crozier I
L.FAYETTE B
RADMORE H
C.Lawrence
RAWLINGS BAY
Mt.Adams
C.Joseph Good
WASHINGTON LAND
C.Wilkes
C.Calhoun
RICHARDSON BAY
C.Collinson
CASS B
SCORESBY B
C.Norton Shaw
GREENLAND
C.Frazer
GOULD BAY
C.L.Napoleon
Washington Irving I
PEABODY BAY
HUMBOLDT GLACIER
KANE BASIN
Brooks I
ADVANCE BAY
C.Scott
DALLAS BAY
MARSHALL B
C.Fredrick VII
INGLEFIELD LAND
BANCROFT B
HYDROGRAPHIC OFFICE U.S.NAVY

GARFIELD
COAST
United States
Mountains
Range
Mt.Whistler
Garfield
LAKE HAZEN
Mt.Connell
Mt.Biederbick
GRINNELL LAND
Conger Mts.
Arthur
Lake
Outlet of Glacier
Lake
AGASSIZ
MER DE GLACE
GREELY FIORD
C.Brainard
Lieut.Lockwood Sergt.Brainard May 15, 16, 1883.
Pyramid Mt
PROMONTORY
JUDGE DALY
Branch Glacier
Mt.Beaumont
Victoria and Albert Mts
ARCHER FIORD
CHANDLER FIORD
LADY FRANKLIN BAY
C.Lieber
C.Craycroft
C.Defosse
CHANNEL
CARL RITTER BAY
Hans I
Franklin I
KENNEDY
C.Constitution
Crozier I
LAFAYETTE B
C.Lawrence
RAWLINGS BAY
C.Joseph Goode
C.Wilkes
RICHARDSON BAY
C.Collinson
SCORESBY B
C.Norton Shaw
DOBBIN BAY
C.Frazer
GOULD BAY
C.Napoleon
Pr.Imperial I
Washington Irving I
C.Hawks
ALLMAN B
John Evans Glacier
FRANKLIN PIERCE BAY
C.Harrison
Walrus Shl
Norman Lockyer I
WOODWARD BAY
C.Baker
PRINCESS MARIE BAY
Bache I.
Victoria Hd
C.Albert
C.Camperdown
Weyprecht Is
C.Long
C.Israel
HAYES SOUND
SCHLEY LAND
Mt.Carey
BUCHANAN STR
Cocked Hat I
C.Sabine
ROSSE B
Stalknecht I
C.Lockwood
Fiord or Channel
ARTHUR LAND
ELLESMERE LAND
Mountains
KANE BASIN
C.Mt.Adams
C.Calhoun
CASS B
ADVANCE BAY
C.Scott
DALLAS BAY
C.Fredrick VII
MARSHALL
BANCROFT B
RENSSELAER BAY
Wr.Qrs. of Advance (Dr.Kane)
INGLEFIELD


C.Union
ROBESON CHANNEL
C.Sumner
NEWMAN BAY
Polaris Promontory
Distant C
Bellot I
LADY FRANKLIN BAY
C.Baird
HALL BASIN
HALL LAND
C.Lieber
C.Craycroft
C.Tyson
C.Morton
CHANNEL
PETERMANN PENA
PETERMANN FIORD
C.Constitution
WASHINGTON LAND
PEABODY BAY
HUMBOLDT GLACIER
G R E E N L A N D
Brooks I
C.Scott
LAND
81°
80°
79°

Drawn by Fred D.Owen.

Published F
J.R.B

NORTH AMERICA

POLAR REGIONS

BAFFIN BAY TO LINCOLN SEA

Showing the most recent discoveries

Including those of

U.S.S. Polaris Expedition in 1871-2 under Captain C.F. Hall

The British Arctic Expedition in 1875-6 under Captain G.S. Nares, R.N.

The Lady Franklin Bay Expedition in 1881-4 under Lieutenant A.W. Greely, U.S.A.

SOUNDINGS IN FATHOMS

HEIGHTS IN FEET

Note

The coast of Greenland east of Beaumont Island and the interior of Grinnell Land, are from the explorations of the Lady Franklin Bay Expedition.

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GREAT ME DE GLACE

PRIDHOE LAND

Mt. Field

Smithson Mts.

C. Acland

EGLEFIELD GULF

Herbert I.

WHALE Sd

C. Powlet

Village (Ittiblu)

Dundas Mts.

C. Parry

GRANVILLE B.

WOLSTENHOLME SOUND

Saunders I.

NORTH STAR B.

Wolstenholme I.

C. Athol

This coast is uncertain in position

Peaked Hill

Petowik Glacier

C. Melville

Leven and Balgoni Is.

C. Dudley Digges

Crimson Cliffs

Conical Rock

Sarwallick Pt. or Iron Mountains

PR. REGENT BAY

C. York

Bushman I

C. Walker

MELVILLE BAY

Thom I.

Sabine I.

70°

65°

60°

lished February 1885 at the tyographic Office, Navy Department, Washington, D.C.
J.R. Bartlett, Commander, U., Hydrographer to the Bureau of Navigation.

Owen.

Published February 1885 at the Hydrographic Office, Navy Depa
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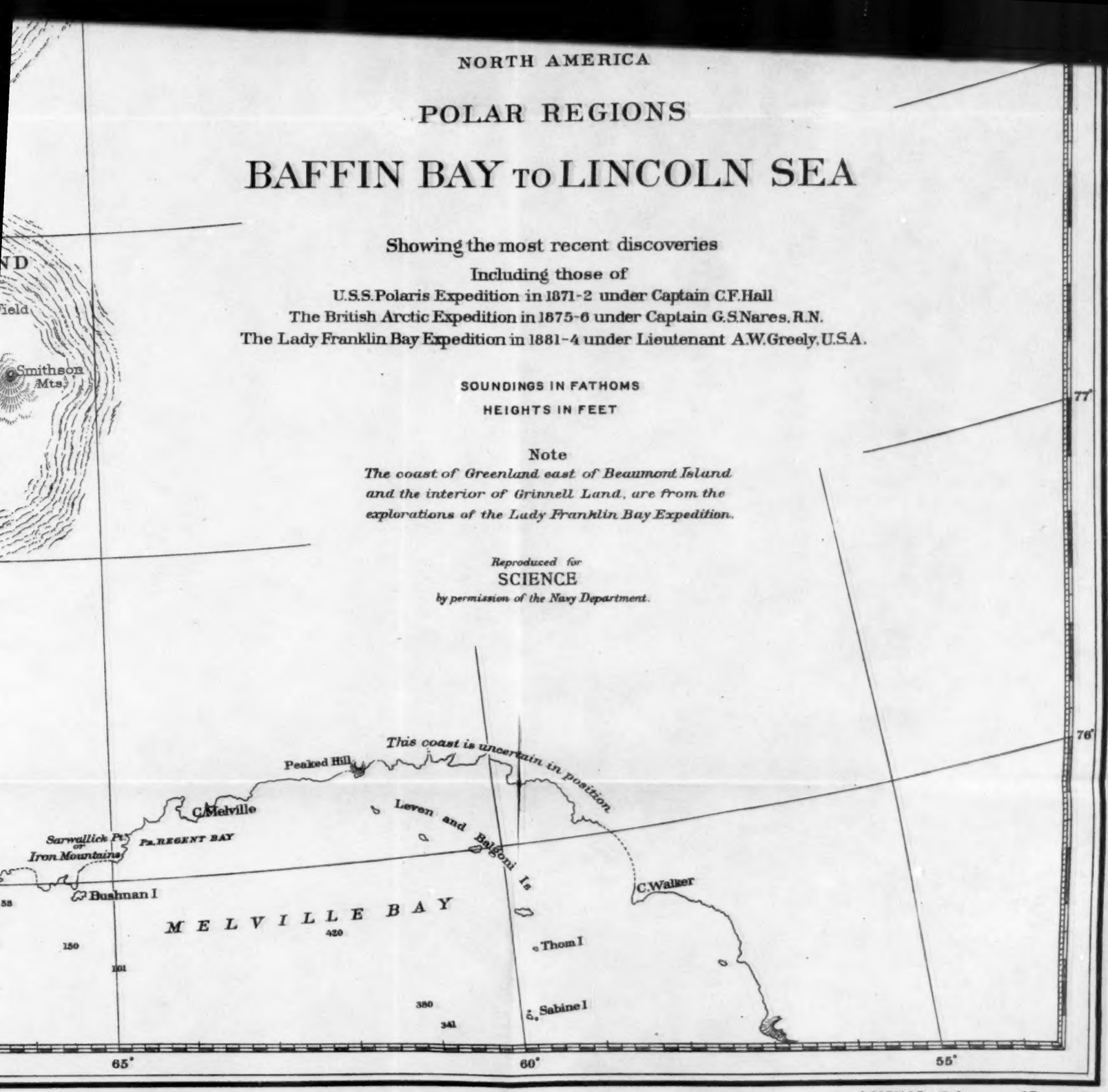

Navy Department, Washington, D.C.
The Bureau of Navigation.

SCIENCE, February 27, 1886.
No. 962

CHART

showing the track of the

"S.S. Neptune"

HUDSON'S BAY EXPEDITION

1884.

PUBLISHED BY THE

Department of Marine

OTTAWA—CANADA

1885.


65°
60°
55°
50°
45°
DAVIS STRAIT
GREENLAND
Godthaab
FROBISHER BAY
STRAIT
FORT BURWELL
UNGAVA BAY
SAYMER'S COVE
NACHVAK B.
NAIN
LABRADOR
Hamilton Inlet
NORTH
ATLANTIC
OCEAN
R. St. Lawrence
Anticosti
GULF OF
ST LAWRENCE
NEWFOUNDLAND
C. Ray
St. John's
C. Race
NEW
BRUNSWICK
NOVA SCOTIA
Halifax
60°
55°
50°
45°